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(54) Title: IMPROVED UNCOMPLEXED CYCLODEXTRIN COMPOSITIONS FOR ODOR CONTROL			
(57) Abstract			
<p>The present invention relates to a stable, aqueous odor-absorbing composition, preferably for use on inanimate surfaces. The composition comprises from about 0.1 % to about 20 %, by weight of the composition, of solubilized, water-soluble, uncomplexed cyclodextrin and an effective amount of at least one ingredient to improve the performance of the composition selected from the group consisting of: (1) cyclodextrin compatible surfactant; (2) cyclodextrin compatible antimicrobial active; and (3) mixtures thereof. Hydrophilic perfume improves acceptance. Optionally, the composition can contain low molecular weight polyols; metallic salts to help control odor; a humectant, etc. The composition is essentially free of any material that would soil or stain fabric. The composition is preferably applied as small particle size droplets, especially from spray containers, preferably non-manually operated sprayers. The cyclodextrin/surfactant combination, either alone, or in combination with the other ingredients, provides improved antimicrobial activity.</p>			

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IMPROVED UNCOMPLEXED CYCLODEXTRIN COMPOSITIONS  
FOR ODOR CONTROL

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TECHNICAL FIELD

The present invention relates to stable, preferably clear, aqueous odor-absorbing compositions, articles of manufacture, and/or method of use, comprising solubilized, uncomplexed cyclodextrin, and cyclodextrin compatible antimicrobial active, cyclodextrin compatible surfactant, cyclodextrin compatible humectant, hydrophilic perfume providing improved acceptance, or mixtures thereof. As used herein, "cyclodextrin compatible" means that the cyclodextrin and the other material, or active, do not substantially interact so as to eliminate the odor controlling ability of the cyclodextrin or the desired effect of the material or active. The odor-absorbing composition is designed to control odors caused by a broad spectrum of organic odoriferous materials, which may, or may not, contain reactive functional groups, and to preferably remain shelf stable for a substantial period of time. Preferably, the aqueous odor-absorbing compositions are for use on inanimate surfaces, especially fabrics, and more specifically, clothes, in order to restore and/or maintain freshness by reducing malodor without the need for washing or dry cleaning.

### BACKGROUND OF THE INVENTION

The present invention relates to stable, preferably clear, aqueous odor absorbing compositions, articles of manufacture and/or method for use, especially on inanimate surfaces, i.e., other than directly on human skin, as an odor-absorbing composition. Such compositions can optionally provide a "scent signal" in the form of a pleasant odor which signals the removal of the malodor. Preferably, the compositions are sprayed onto fabrics, particularly clothes, to restore their freshness by reducing malodor without washing or dry cleaning. The aqueous odor-absorbing compositions are also preferably for use on other inanimate surfaces, such as household upholstery, drapes, carpets, car interiors, and the like. They also can be used on, e.g., human and animal surfaces, e.g., skin, hair, etc.

Uncomplexed cyclodextrin molecules, which are made up of varying numbers of glucose units provide the absorbing advantages of known absorbent deodorizing compositions without harmful effects to fabrics. While cyclodextrin is an effective odor absorbing active, some small molecules are not sufficiently absorbed by the cyclodextrin molecules because the cavity of the cyclodextrin molecule may be too large to adequately hold the smaller organic molecule. If a small sized organic odor molecule is not sufficiently absorbed into the cyclodextrin cavity, a substantial amount of malodor can remain. In order to alleviate this problem, low molecular weight polyols can be added to the composition to enhance the formation of cyclodextrin inclusion complexes. Furthermore, optional water soluble metal salts can be added to complex with some nitrogen-containing and sulfur-containing malodor molecules.

Since cyclodextrin is a prime breeding ground for certain microorganisms, especially when in aqueous compositions, it is preferable to include a water-soluble antimicrobial preservative, which is effective for inhibiting and/or regulating microbial growth, to increase storage stability of clear, aqueous odor-absorbing solutions containing water-soluble cyclodextrin, when the composition does not contain an antimicrobial material as described hereinafter.

It is desirable to provide further improvements such as a cyclodextrin compatible antimicrobial active that provides substantial kill of organisms that cause, e.g., odor, infections, etc. It is also desirable that the compositions contain a cyclodextrin compatible surfactant to promote spreading of the odor absorbing composition on hydrophobic surfaces such as polyester, nylon, etc. as well as to penetrate any oily, hydrophobic soil for improved malodor control. Furthermore, it is desirable that the cyclodextrin-compatible surfactant provide in-wear electrostatic control. It is more preferable that the odor absorbing composition of the present invention contain both a cyclodextrin-compatible antibacterial active and a cyclodextrin-compatible surfactant. A cyclodextrin-compatible active is one which does not substantially forms complex with

cyclodextrin in the composition, at the usage concentration, so that an effective amount of both the free, uncomplexed active and free, uncomplexed cyclodextrin are available for their intended use. Furthermore, it is desirable to include a humectant to maintain a desirable moisture level in cotton fabrics while they dry to maximize dewrinkling.

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### SUMMARY OF THE INVENTION

The present invention relates to an article of manufacture comprising a non-manually operated spray dispenser comprising a spray head and a reservoir, said reservoir containing a stable, preferably clear, aqueous odor-absorbing composition, preferably for use on inanimate surfaces, comprising:

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(A). an effective amount to absorb malodors, typically from about 0.01% to about 20% by weight of the composition, with concentrated compositions which are meant to be diluted containing from about 3% to about 20%, preferably from about 5% to about 10% by weight of the composition, and, for more dilute "usage conditions" compositions, a range of from about 0.01% to about 5%, preferably from about 0.1% to about 3%, more preferably from about 0.5% to about 2%, by weight of the usage composition, of solubilized, uncomplexed cyclodextrin:

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(B). optionally, an effective amount to improve the performance of the composition, preferably from about 0.01% to about 2%, more preferably from about 0.03% to about 0.6%, and even more preferably from about 0.05% to about 0.3%, by weight of the usage composition, of cyclodextrin compatible surfactant that preferably provides a surface tension of from about 20 dyne/cm to about 60 dyne/cm, preferably from about 20 dyne/cm to about 45 dyne/cm (with concentrated compositions having a level of from about 0.1% to about 8%, preferably from about 0.2% to about 4%, more preferably from about 0.3% to about 3%, by weight of the concentrated solution, of cyclodextrin-compatible surfactant);

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(C). optionally, an effective amount, to kill, or reduce the growth of microbes, of cyclodextrin compatible and water soluble antimicrobial active, preferably from about 0.001% to about 0.8%, more preferably from about 0.002% to about 0.3%, even more preferably from about 0.003% to about 0.2%, by weight of the usage composition, and preferably selected from the group consisting of halogenated compounds, cyclic nitrogen compounds, quaternary compounds, and phenolic compounds (with concentrated compositions having a level of from about 0.003%

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to about 2%, preferably from about 0.01% to about 1.2%, more preferably from about 0.1% to about 0.8%, by weight of the concentrated solution, of cyclodextrin-compatible and water soluble antimicrobial active);

5 (D). optionally, but preferably, an effective amount to improve acceptance of the composition, typically from about 0.003% to about 0.5%, preferably from about 0.01% to about 0.3%, more preferably from about 0.05% to about 0.2%, by weight of the usage composition of hydrophilic perfume, containing at least about 50%, preferably at least about 60%, more preferably at least about 60%, even more preferably at least about 70%, and yet more preferably at least about 80%,  
10 by weight of the perfume of perfume ingredients that have a ClogP of less than about 3.5 and optionally, a minor amount of perfume ingredients selected from the group consisting of ambrox, bacdanol, benzyl salicylate, butyl anthranilate, cetalox, damascenone, alpha-damascone, gamma-dodecalactone, ebanol, herbavert, cis-3-hexenyl salicylate, alpha-ionone, beta-ionone, alpha-isomethylionone, lillal, methyl nonyl ketone, gamma-undecalactone, undecylenic aldehyde, and mixtures thereof;

(E). optionally, but preferably, from about 0.01% to about 3%, more preferably from about 0.05% to about 1%, and even more preferably from about 0.1% to about 0.5%, by weight of the usage composition of low molecular weight polyol;

20 (F). optionally, from about 0.001% to about 0.3%, preferably from about 0.01% to about 0.1%, more preferably from about 0.02% to about 0.05%, by weight of the usage composition of aminocarboxylate chelator;

(G). optionally, but preferably, an effective amount of metallic salt, preferably from about 0.1% to about 10%, more preferably from about 0.2% to about 8%, even more preferably from about 0.3% to about 5% by weight of the usage composition, especially water soluble copper and/or zinc salts, for improved odor benefit;

25 (H). optionally, an effective amount of enzyme, from about 0.0001% to about 0.5%, preferably from about 0.001% to about 0.3%, more preferably from about 0.005% to about 0.2% by weight of the usage composition, for improved odor control benefit;

30 (I). optionally, an effective amount of solubilized, water-soluble, antimicrobial preservative, preferably from about 0.0001% to about 0.5%, more preferably

from about 0.0002% to about 0.2%, most preferably from about 0.0003% to about 0.1%, by weight of the composition; and

(J). aqueous carrier.

said composition preferably containing at least one of (B) and (C) and preferably being essentially  
5 free of any material that would soil or stain fabric under usage conditions, and/or preferably having a pH of more than about 3, more preferably more than about 3.5, said non-manual spray means preferably being able to provide a spray having a weight average particle diameter of from about 20  $\mu\text{m}$  to about 120  $\mu\text{m}$ .

The present invention also relates to concentrated compositions, wherein the level of  
10 cyclodextrin is from about 3% to about 20%, more preferably from about 5% to about 10%, by weight of the composition which are diluted to form compositions with the usage concentrations of cyclodextrin of, e.g., from about 0.1% to about 5%, by weight of the diluted composition, as given hereinabove, which are to the "usage conditions". These concentrated compositions can be used in a process for preparing large volumes of treatment composition in which water is added, either in a  
15 separate container, or in the container of the article of manufacture comprising the spray means.

The present invention also relates to the compositions incorporated into a spray dispenser to create an article of manufacture that can facilitate treatment of articles and/or surfaces with said compositions containing uncomplexed cyclodextrin and other optional ingredients at a level that is effective, yet is not discernible when dried on the surfaces. The present invention includes the  
20 preferred non-manually operated sprayers for treating the odor-absorbing compositions to large surface areas and/or objects. In a preferred embodiment, the container with the composition inside can comprise mechanical structure that mates with structure on the sprayer head to ensure that the container is held firmly without leakage. Such structure can be provided by several different means, but is important to the successful use of the invention. Typically, motion and impacts will  
25 tend to loosen the container. When the package for the refill is made by high volume processes, there is a very strong need for "lock and key" structure to minimize the chances for spills.

The present invention also comprises the use of small particle diameter droplets of the compositions herein, even those which do not contain (B) or (C), to treat surfaces, especially fabrics, to provide superior performance, e.g., the method of applying the compositions to fabrics,  
30 etc. as very small particles (droplets) preferably having average particle sizes (diameters) of from about 10  $\mu\text{m}$  to about 120  $\mu\text{m}$ , more preferably from about 20  $\mu\text{m}$  to about 100  $\mu\text{m}$ .

In another aspect of the invention herein, compositions that contain combinations of water soluble antimicrobial actives, especially those described hereinafter, and especially the bisbiguanide alkane compounds described hereinafter, and the surfactants described hereinafter,

especially the polyalkyleneoxide polysiloxanes described hereinafter provide superior antimicrobial action in aqueous solutions, either by themselves, or in combination with the other ingredients, including the cyclodextrin.



DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to an article of manufacture comprising a non-manual spray dispenser comprising a spray head and a reservoir, said reservoir containing a stable, preferably clear, aqueous odor-absorbing composition, preferably for use on inanimate surfaces, comprising:

- 5 (A). an effective amount to absorb malodors, typically from about 0.01% to about 20% by weight of the composition, with concentrated compositions which are meant to be diluted containing from about 3% to about 20%, preferably from about 5% to about 10% by weight of the composition, and, for more dilute "usage conditions" compositions, a range of from about 0.01% to about 5%, preferably from about 0.1% to about 3%, more preferably from about 0.5% to about 2%, by weight of the usage composition, of solubilized, uncomplexed cyclodextrin;
- 10 (B). optionally, an effective amount to improve the performance of the composition, preferably from about 0.01% to about 2%, more preferably from about 0.03% to about 0.6%, and even more preferably from about 0.05% to about 0.3%, by weight of the usage composition, of cyclodextrin compatible surfactant that preferably provides a surface tension of from about 20 dyne/cm to about 60 dyne/cm, preferably from about 20 dyne/cm to about 45 dyne/cm (with concentrated compositions having a level of from about 0.1% to about 8%, preferably from about 0.2% to about 4%, more preferably from about 0.3% to about 3%, by weight of the concentrated solution, of cyclodextrin-compatible surfactant);
- 15 (C). optionally, an effective amount, to kill, or reduce the growth of microbes, of cyclodextrin compatible and water soluble antimicrobial active, preferably from about 0.001% to about 0.8%, more preferably from about 0.002% to about 0.3%, even more preferably from about 0.003% to about 0.2%, by weight of the usage composition, and preferably selected from the group consisting of halogenated compounds, cyclic nitrogen compounds, quaternary compounds, and phenolic compounds (with concentrated compositions having a level of from about 0.003% to about 2%, preferably from about 0.01% to about 1.2%, more preferably from about 0.1% to about 0.8%, by weight of the concentrated solution, of cyclodextrin-compatible and water soluble antimicrobial active);
- 20 (D). optionally, but preferably, an effective amount to improve acceptance of the composition, typically from about 0.003% to about 0.5%, preferably from about 0.01% to about 0.3%, more preferably from about 0.05% to about 0.2%, by
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- weight of the usage composition of hydrophilic perfume, containing at least about 50%, preferably at least about 60%, more preferably at least about 60%, even more preferably at least about 70%, and yet more preferably at least about 80%, by weight of the perfume of perfume ingredients that have a ClogP of less than about 3.5 and optionally, a minor amount of perfume ingredients selected from the group consisting of ambrox, bacdanol, benzyl salicylate, butyl anthranilate, cetalox, damascenone, alpha-damascone, gamma-dodecalactone, ebanol, herbavert, cis-3-hexenyl salicylate, alpha-ionone, beta-ionone, alpha-isomethylionone, lilial, methyl nonyl ketone, gamma-undecalactone, undecylenic aldehyde, and mixtures thereof;
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- (E). optionally, but preferably, from about 0.01% to about 3%, more preferably from about 0.05% to about 1%, and even more preferably from about 0.1% to about 0.5%, by weight of the usage composition of low molecular weight polyol;
- (F). optionally, from about 0.001% to about 0.3%, preferably from about 0.01% to about 0.1%, more preferably from about 0.02% to about 0.05%, by weight of the usage composition of aminocarboxylate chelator;
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- (G). optionally, but preferably, an effective amount of metallic salt, preferably from about 0.1% to about 10%, more preferably from about 0.2% to about 8%, even more preferably from about 0.3% to about 5% by weight of the usage composition, especially water soluble copper and/or zinc salts, for improved odor benefit;
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- (H). optionally, an effective amount of enzyme, from about 0.0001% to about 0.5%, preferably from about 0.001% to about 0.3%, more preferably from about 0.005% to about 0.2% by weight of the usage composition, for improved odor control benefit;
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- (I). optionally, an effective amount of solubilized, water-soluble, antimicrobial preservative, preferably from about 0.0001% to about 0.5%, more preferably from about 0.0002% to about 0.2%, most preferably from about 0.0003% to about 0.1%, by weight of the composition; and
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- (J). aqueous carrier,

said composition preferably containing at least one of (B) and (C) and preferably being essentially free of any material that would soil or stain fabric under usage conditions, and/or preferably having a pH of more than about 3, more preferably more than about 3.5, said non-manually spray means

preferably being able to provide a spray having a weight average particle diameter of from about 20  $\mu\text{m}$  to about 120  $\mu\text{m}$ .

The present invention also relates to concentrated compositions, wherein the level of cyclodextrin is from about 3% to about 20%, preferably from about 4% to about 15%, more preferably from about 5% to about 10%, by weight of the concentrated composition. The concentrated composition is typically diluted to form usage compositions, with the usage concentration of, e.g., from about 0.1% to about 5%, by weight of the usage composition, as given hereinabove. Specific levels of other optional ingredients in the concentrated composition can readily be determined from the desired usage composition and the desired degree of concentration.

10 These concentrated compositions can be used in a process for preparing large volumes of treatment composition in which water is added, either in a separate container, or in the container of the article of manufacture comprising the spray means.

The present invention also relates to the compositions incorporated into an article comprising spray dispenser means to create an article of manufacture that can facilitate treatment of articles and/or surfaces with said compositions containing uncomplexed cyclodextrin and other optional ingredients at a level that is effective, yet is not discernible when dried on the surfaces. The present invention includes the preferred non-manually operated spray dispensers for treating the odor-absorbing compositions to large surface areas and/or objects. Non-manually operated spray dispensers include, but are not limited to, powered sprayers, air aspirated sprayers, liquid aspirated sprayers, electrostatic sprayers, and nebulizer sprayers, preferably powered sprayers, more preferably battery-operated sprayers, and even more preferably rechargeable battery-operated sprayers. These non-manually operated spray dispensers are desirable for many reasons, including improving the ability of unskilled consumers to apply the treatment compositions evenly to all parts of the area to be treated. If one very odorous part is missed, the benefits will be lost and/or significantly diminished. If an area is treated too heavily, the time to dry is unduly extended.

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In a preferred embodiment, the container with the composition inside can comprise mechanical structure that mates with structure on the sprayer to ensure that the container is held firmly without leakage. Such structure can be provided by several different means, but is important to the successful use of the invention. Typically, motion and impacts will tend to loosen the container. When the package for the refill is made by high volume processes, there is a very strong need for "lock and key" structure to minimize the chances for spills. Furthermore, the spray dispenser preferably comprises a fluid reservoir for said composition which is attached to the spray dispenser by means allowing the reservoir to be replaced by a refill container having the same shape as the reservoir. The spray dispenser has structure that mates with both the reservoir and/or

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the refill container to ensure a good seal and proper positioning of the container and reservoir with respect to said spray dispenser.

The present invention also comprises the use of small particle diameter droplets of the compositions herein, even those which do not contain (B) or (C), to treat surfaces, especially fabrics, to provide superior performance, e.g., the method of applying the compositions to fabrics, etc. as very small particles (droplets) preferably having average particle sizes (diameters) of from about 10  $\mu\text{m}$  to about 120  $\mu\text{m}$ , more preferably from about 20  $\mu\text{m}$  to about 100  $\mu\text{m}$ .

In another aspect of the invention herein, compositions that contain combinations of water soluble antimicrobial actives, especially those described hereinafter, and especially the bis-biguanide alkane compounds described hereinafter, and the surfactants described hereinafter, especially the polyalkyleneoxide polysiloxanes described hereinafter provide superior antimicrobial action in aqueous solutions, either by themselves, or in combination with the other ingredients, including the cyclodextrin.

## I. COMPOSITION

### (A). CYCLODEXTRIN

As used herein, the term "cyclodextrin" includes any of the known cyclodextrins such as unsubstituted cyclodextrins containing from six to twelve glucose units, especially, alpha-cyclodextrin, beta-cyclodextrin, gamma-cyclodextrin and/or their derivatives and/or mixtures thereof. The alpha-cyclodextrin consists of six glucose units, the beta-cyclodextrin consists of seven glucose units, and the gamma-cyclodextrin consists of eight glucose units arranged in donut-shaped rings. The specific coupling and conformation of the glucose units give the cyclodextrins a rigid, conical molecular structures with hollow interiors of specific volumes. The "lining" of each internal cavity is formed by hydrogen atoms and glycosidic bridging oxygen atoms; therefore, this surface is fairly hydrophobic. The unique shape and physical-chemical properties of the cavity enable the cyclodextrin molecules to absorb (form inclusion complexes with) organic molecules or parts of organic molecules which can fit into the cavity. Many odorous molecules can fit into the cavity including many malodorous molecules and perfume molecules. Therefore, cyclodextrins, and especially mixtures of cyclodextrins with different size cavities, can be used to control odors caused by a broad spectrum of organic odoriferous materials, which may, or may not, contain reactive functional groups. The complexation between cyclodextrin and odorous molecules occurs rapidly in the presence of water. However, the extent of the complex formation also depends on the polarity of the absorbed molecules. In an aqueous solution, strongly hydrophilic molecules (those which are highly water-soluble) are only partially absorbed, if at all. Therefore, cyclodextrin does

not complex effectively with some very low molecular weight organic amines and acids when they are present at low levels on wet fabrics. As the water is being removed however, e.g., the fabric is being dried off, some low molecular weight organic amines and acids have more affinity and will complex with the cyclodextrins more readily.

5           The cavities within the cyclodextrin in the solution of the present invention should remain essentially unfilled (the cyclodextrin remains uncomplexed) while in solution, in order to allow the cyclodextrin to absorb various odor molecules when the solution is applied to a surface. Non-derivatised (normal) beta-cyclodextrin can be present at a level up to its solubility limit of about 1.85% (about 1.85g in 100 grams of water) at room temperature. Beta-cyclodextrin is not preferred  
10       in compositions which call for a level of cyclodextrin higher than its water solubility limit. Non-derivatised beta-cyclodextrin is generally not preferred when the composition contains surfactant since it affects the surface activity of most of the preferred surfactants that are compatible with the derivatized cyclodextrins.

          Preferably, the odor absorbing solution of the present invention is clear. The term "clear"  
15       as defined herein means transparent or translucent, preferably transparent, as in "water clear," when observed through a layer having a thickness of less than about 10 cm.

          Preferably, the cyclodextrins used in the present invention are highly water-soluble such as, alpha-cyclodextrin and/or derivatives thereof, gamma-cyclodextrin and/or derivatives thereof, derivatised beta-cyclodextrins, and/or mixtures thereof. The derivatives of cyclodextrin consist  
20       mainly of molecules wherein some of the OH groups are converted to OR groups. Cyclodextrin derivatives include, e.g., those with short chain alkyl groups such as methylated cyclodextrins, and ethylated cyclodextrins, wherein R is a methyl or an ethyl group; those with hydroxyalkyl substituted groups, such as hydroxypropyl cyclodextrins and/or hydroxyethyl cyclodextrins, wherein R is a -CH<sub>2</sub>-CH(OH)-CH<sub>3</sub> or a -CH<sub>2</sub>CH<sub>2</sub>-OH group; branched cyclodextrins such as  
25       maltose-bonded cyclodextrins; cationic cyclodextrins such as those containing 2-hydroxy-3-(dimethylamino)propyl ether, wherein R is CH<sub>2</sub>-CH(OH)-CH<sub>2</sub>-N(CH<sub>3</sub>)<sub>2</sub> which is cationic at low pH; quaternary ammonium, e.g., 2-hydroxy-3-(trimethylammonio)propyl ether chloride groups, wherein R is CH<sub>2</sub>-CH(OH)-CH<sub>2</sub>-N<sup>+</sup>(CH<sub>3</sub>)<sub>3</sub>Cl<sup>-</sup>; anionic cyclodextrins such as carboxymethyl cyclodextrins, cyclodextrin sulfates, and cyclodextrin succinylates; amphoteric cyclodextrins such  
30       as carboxymethyl/quaternary ammonium cyclodextrins; cyclodextrins wherein at least one glucopyranose unit has a 3-6-anhydro-cyclomalto structure, e.g., the mono-3-6-anhydrocyclodextrins, as disclosed in "Optimal Performances with Minimal Chemical Modification of Cyclodextrins", F. Diedaini-Pilard and B. Perly, The 7th International Cyclodextrin Symposium Abstracts, April 1994, p. 49, said references being incorporated herein by reference;

and mixtures thereof. Other cyclodextrin derivatives are disclosed in U.S. Pat. Nos: 3,426,011, Parmerter et al., issued Feb. 4, 1969; 3,453,257; 3,453,258; 3,453,259; and 3,453,260, all in the names of Parmerter et al., and all issued July 1, 1969; 3,459,731, Gramera et al., issued Aug. 5, 1969; 3,553,191, Parmerter et al., issued Jan. 5, 1971; 3,565,887, Parmerter et al., issued Feb. 23, 5 1971; 4,535,152, Szejtli et al., issued Aug. 13, 1985; 4,616,008, Hirai et al., issued Oct. 7, 1986; 4,678,598, Ogino et al., issued Jul. 7, 1987; 4,638,058, Brandt et al., issued Jan. 20, 1987; and 4,746,734, Tsuchiyama et al., issued May 24, 1988; all of said patents being incorporated herein by reference.

Highly water-soluble cyclodextrins are those having water solubility of at least about 10 g 10 in 100 ml of water at room temperature, preferably at least about 20 g in 100 ml of water, more preferably at least about 25 g in 100 ml of water at room temperature. The availability of solubilized, uncomplexed cyclodextrins is essential for effective and efficient odor control performance. Solubilized, water-soluble cyclodextrin can exhibit more efficient odor control performance than non-water-soluble cyclodextrin when deposited onto surfaces, especially fabric.

15 Examples of preferred water-soluble cyclodextrin derivatives suitable for use herein are hydroxypropyl alpha-cyclodextrin, methylated alpha-cyclodextrin, methylated beta-cyclodextrin, hydroxyethyl beta-cyclodextrin, and hydroxypropyl beta-cyclodextrin. Hydroxyalkyl cyclodextrin derivatives preferably have a degree of substitution of from about 1 to about 14, more preferably from about 1.5 to about 7, wherein the total number of OR groups per cyclodextrin is defined as the 20 degree of substitution. Methylated cyclodextrin derivatives typically have a degree of substitution of from about 1 to about 18, preferably from about 3 to about 16. A known methylated beta-cyclodextrin is heptakis-2,6-di-O-methyl- $\beta$ -cyclodextrin, commonly known as DIMEB, in which each glucose unit has about 2 methyl groups with a degree of substitution of about 14. A preferred, more commercially available, methylated beta-cyclodextrin is a randomly methylated beta- 25 cyclodextrin, commonly known as RAMEB, having different degrees of substitution, normally of about 12.6. RAMEB is more preferred than DIMEB, since DIMEB affects the surface activity of the preferred surfactants more than RAMEB. The preferred cyclodextrins are available, e.g., from Cerestar USA, Inc. and Wacker Chemicals (USA), Inc.

It is also preferable to use a mixture of cyclodextrins. Such mixtures absorb odors more 30 broadly by complexing with a wider range of odoriferous molecules having a wider range of molecular sizes. Preferably at least a portion of the cyclodextrins is alpha-cyclodextrin and its derivatives thereof, gamma-cyclodextrin and its derivatives thereof, and/or derivatised beta-cyclodextrin, more preferably a mixture of alpha-cyclodextrin, or an alpha-cyclodextrin derivative, and derivatised beta-cyclodextrin, even more preferably a mixture of derivatised alpha-cyclodextrin

and derivatised beta-cyclodextrin, most preferably a mixture of hydroxypropyl alpha-cyclodextrin and hydroxypropyl beta-cyclodextrin, and/or a mixture of methylated alpha-cyclodextrin and methylated beta-cyclodextrin.

For controlling odor on fabrics, the composition is preferably used as a spray. It is  
5 preferable that the usage compositions of the present invention contain low levels of cyclodextrin so that a visible stain does not appear on the fabric at normal usage levels. Preferably, the solution used to treat the surface under usage conditions is virtually not discernible when dry. Typical levels of cyclodextrin in usage compositions for usage conditions are from about 0.01% to about 5%,  
10 preferably from about 0.1% to about 4%, more preferably from about 0.5% to about 2% by weight of the composition. Compositions with higher concentrations can leave unacceptable visible stains on fabrics as the solution evaporates off of the fabric. This is especially a problem on thin, colored, synthetic fabrics. In order to avoid or minimize the occurrence of fabric staining, it is preferable that the fabric be treated at a level of less than about 5 mg of cyclodextrin per gram of fabric, more preferably less than about 2 mg of cyclodextrin per gram of fabric. The presence of the surfactant  
15 can improve appearance by minimizing localized spotting.

Concentrated compositions can also be used in order to deliver a less expensive product. When a concentrated product is used, i.e., when the level of cyclodextrin used is from about 3% to about 20%, more preferably from about 5% to about 10%, by weight of the concentrated composition, it is preferable to dilute the concentrated composition before treating fabrics in order  
20 to avoid staining. Preferably the concentrated cyclodextrin composition is diluted with about 50% to about 6000%, more preferably with about 75% to about 2000%, most preferably with about 100% to about 1000% by weight of the concentrated composition of water. The resulting diluted compositions have usage concentrations of cyclodextrin as discussed hereinbefore, e.g., of from about 0.1% to about 5%, by weight of the diluted composition.

#### 25 (B). CYCLODEXTRIN-COMPATIBLE SURFACTANT

The cyclodextrin-compatible surfactant B., provides a low surface tension that permits the composition to spread readily and more uniformly on hydrophobic surfaces like polyester and nylon. It has been found that the aqueous solution, without such a surfactant will not spread satisfactorily. The spreading of the composition also allows it to dry faster, so that the treated  
30 material is ready to use sooner. Furthermore, the composition containing a cyclodextrin-compatible surfactant can penetrate hydrophobic, oily soil better for improved malodor control. The composition containing a cyclodextrin-compatible surfactant also provides improved "in-wear" electrostatic control. For concentrated compositions, the surfactant facilitates the dispersion of many actives such as antimicrobial actives and perfumes in the concentrated aqueous compositions.

The surfactant for use in providing the required low surface tension in the composition of the present invention should be cyclodextrin-compatible, that is it should not substantially form a complex with the cyclodextrin so as to diminish performance of the cyclodextrin and/or the surfactant. Complex formation diminishes both the ability of the cyclodextrin to absorb odors and the ability of the surfactant to lower the surface tension of the aqueous composition.

Suitable cyclodextrin-compatible surfactants can be readily identified by the absence of effect of cyclodextrin on the surface tension provided by the surfactant. This is achieved by determining the surface tension (in dyne/cm<sup>2</sup>) of aqueous solutions of the surfactant in the presence and in the absence of about 1% of a specific cyclodextrin in the solutions. The aqueous solutions contain surfactant at concentrations of approximately 0.5%, 0.1%, 0.01%, and 0.005%. The cyclodextrin can affect the surface activity of a surfactant by elevating the surface tension of the surfactant solution. If the surface tension at a given concentration in water differs by more than about 10% from the surface tension of the same surfactant in the 1% solution of the cyclodextrin, that is an indication of a strong interaction between the surfactant and the cyclodextrin. The preferred surfactants herein should have a surface tension in an aqueous solution that is different (lower) by less than about 10%, preferably less than about 5%, and more preferably less than about 1% from that of the same concentration solution containing 1% cyclodextrin.

Nonlimiting examples of cyclodextrin-compatible nonionic surfactants include block copolymers of ethylene oxide and propylene oxide. Suitable block polyoxyethylene-polyoxypropylene polymeric surfactants, that are compatible with most cyclodextrins, include those based on ethylene glycol, propylene glycol, glycerol, trimethylolpropane and ethylenediamine as the initial reactive hydrogen compound. Polymeric compounds made from a sequential ethoxylation and propoxylation of initial compounds with a single reactive hydrogen atom, such as C<sub>12-18</sub> aliphatic alcohols, are not generally compatible with the cyclodextrin. Certain of the block polymer surfactant compounds designated Pluronic<sup>®</sup> and Tetronic<sup>®</sup> by the BASF-Wyandotte Corp., Wyandotte, Michigan, are readily available.

Nonlimiting examples of cyclodextrin-compatible surfactants of this type include:

Pluronic Surfactants with the general formula  $H(EO)_n(PO)_m(EO)_nH$ ,

wherein EO is an ethylene oxide group, PO is a propylene oxide group, and n and m are numbers that indicate the average number of the groups in the surfactants.

Typical examples of cyclodextrin-compatible Pluronic surfactants are:

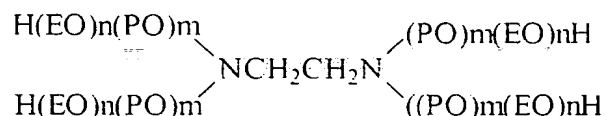
Name	Average MW	Average n	Average m
L-101	3,800	4	59
L-81	2,750	3	42



L-44	2,200	10	23
L-43	1,850	6	22
F-38	4,700	43	16
P-84	4,200	19	43,

5 and mixtures thereof.

Tetronic Surfactants with the general formula:



wherein EO, PO, n, and m have the same meanings as above. Typical examples of cyclodextrin-compatible Tetronic surfactants are:

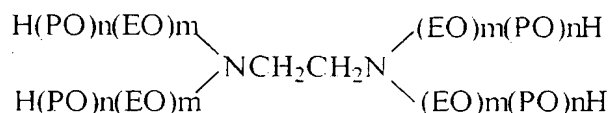
10	Name	Average MW	Average n	Average m
	901	4,700	3	18
	908	25,000	114	22,

and mixtures thereof.

"Reverse" Pluronic and Tetronic surfactants have the following general formulas:

15 Reverse Pluronic Surfactants  $\text{H(PO)}_m\text{(EO)}_n\text{(PO)}_m\text{H}$

Reverse Tetronic Surfactants



wherein EO, PO, n, and m have the same meanings as above. Typical examples of cyclodextrin-compatible Reverse Pluronic and Reverse Tetronic surfactants are:

20 Reverse Pluronic surfactants:

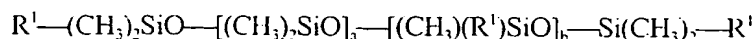
Name	Average MW	Average n	Average m
10 R5	1,950	8	22
25 R1	2,700	21	6

Reverse Tetronic surfactants

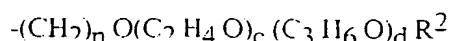
25	Name	Average MW	Average n	Average m
	130 R2	7,740	9	26
	70 R2	3,870	4	13

and mixtures thereof.

A preferred class of cyclodextrin-compatible nonionic surfactants are the polyalkyleneoxide polysiloxanes having a dimethyl polysiloxane hydrophobic moiety and one or more hydrophilic polyalkylene side chains and have the general formula:



- 5 wherein a + b are from about 1 to about 50, preferably from about 3 to about 30, more preferably from about 10 to about 25, and each R<sup>1</sup> is the same or different and is selected from the group consisting of methyl and a poly(ethyleneoxide/propyleneoxide) copolymer groups having the general formula:



- 10 with at least one R<sup>1</sup> being a poly(ethyleneoxide/propyleneoxide) copolymer group, and wherein n is 3 or 4, preferably 3; total c (for all polyalkyleneoxy side groups) has a value of from 1 to about 100, preferably from about 6 to about 100; total d is from 0 to about 14, preferably from 0 to about 3; and more preferably d is 0; total c+d has a value of from about 5 to about 150, preferably from about 9 to about 100 and each R<sup>2</sup> is the same or different and is selected from the group consisting of hydrogen.  
15 an alkyl having 1 to 4 carbon atoms, and an acetyl group, preferably hydrogen and methyl group.

Examples of this type of surfactants are the Silwet<sup>®</sup> surfactants which are available OSi Specialties, Inc., Danbury, Connecticut. Representative Silwet surfactants are as follows.

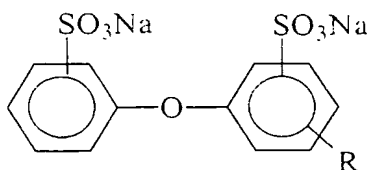
Name	Average MW	Average a+b	Average total c
L-7608	600	1	9
20 L-7607	1,000	2	17
L-77	600	1	9
L-7605	6,000	20	99
L-7604	4,000	21	53
L-7600	4,000	11	68
25 L-7657	5,000	20	76
L-7602	3,000	20	29

- The molecular weight of the polyalkyleneoxy group (R<sup>1</sup>) is less than or equal to about 10,000. Preferably, the molecular weight of the polyalkyleneoxy group is less than or equal to about 8,000, and most preferably ranges from about 300 to about 5,000. Thus, the values of c and d can be  
30 those numbers which provide molecular weights within these ranges. However, the number of ethyleneoxy units (-C<sub>2</sub>H<sub>4</sub>O) in the polyether chain (R<sup>1</sup>) must be sufficient to render the polyalkyleneoxide polysiloxane water dispersible or water soluble. If propyleneoxy groups are present in the polyalkyleneoxy chain, they can be distributed randomly in the chain or exist as blocks. Preferred Silwet surfactants are L-7600, L-7602, L-7604, L-7605, L-7657, and mixtures thereof.

Besides surface activity, polyalkyleneoxide polysiloxane surfactants can also provide other benefits, such as antistatic benefits, lubricity and softness to fabrics.

The preparation of polyalkyleneoxide polysiloxanes is well known in the art. Polyalkyleneoxide polysiloxanes of the present invention can be prepared according to the procedure set forth in U.S. Pat. No. 3,299,112, incorporated herein by reference. Typically, polyalkyleneoxide polysiloxanes of the surfactant blend of the present invention are readily prepared by an addition reaction between a hydrosiloxane (i.e., a siloxane containing silicon-bonded hydrogen) and an alkenyl ether (e.g., a vinyl, allyl, or methallyl ether) of an alkoxy or hydroxy end-blocked polyalkylene oxide). The reaction conditions employed in addition reactions of this type are well known in the art and in general involve heating the reactants (e.g., at a temperature of from about 85° C. to 110° C.) in the presence of a platinum catalyst (e.g., chloroplatinic acid) and a solvent (e.g., toluene).

Nonlimiting examples of cyclodextrin-compatible anionic surfactants are the alkyldiphenyl oxide disulfonate, having the general formula:



wherein R is an alkyl group. Examples of this type of surfactants are available from the Dow Chemical Company under the trade name Dowfax<sup>®</sup> wherein R is a linear or branched C<sub>6</sub>-C<sub>16</sub> alkyl group. An example of these cyclodextrin-compatible anionic surfactant is Dowfax 3B2 with R being approximately a linear C<sub>10</sub> group. These anionic surfactants are preferably not used when the antimicrobial active or preservative, etc., is cationic to minimize the interaction with the cationic actives, since the effect of both surfactant and active are diminished.

The surfactants above are either weakly interactive with cyclodextrin (less than 5% elevation in surface tension, or non-interactive (less than 1% elevation in surface tension). Normal surfactants like sodium dodecyl sulfate and dodecanolpoly(6)ethoxylate are strongly interactive, with more than a 10% elevation in surface tension in the presence of a typical cyclodextrin like hydroxypropylbeta-cyclodextrin and methylated beta-cyclodextrin.

Typical levels of cyclodextrin-compatible surfactants in usage compositions are from about 0.01% to about 2%, preferably from about 0.03% to about 0.6%, more preferably from about 0.05% to about 0.3%, by weight of the composition. Typical levels of cyclodextrin-compatible surfactants in concentrated compositions are from about 0.1% to about 8%, preferably from about

0.2% to about 4%, more preferably from about 0.3% to about 3%, by weight of the concentrated composition.

(C). CYCLODEXTRIN-COMPATIBLE ANTIMICROBIAL ACTIVE

The solubilized, water-soluble antimicrobial active, C., is useful in providing protection  
5 against organisms that become attached to the treated material. The antimicrobial should be cyclodextrin-compatible, e.g., not substantially forming complexes with the cyclodextrin in the odor absorbing composition. The free, uncomplexed antimicrobial, e.g., antibacterial, active provides an optimum antibacterial performance.

Sanitization of fabrics can be achieved by the compositions of the present invention  
10 containing, antimicrobial materials, e.g., antibacterial halogenated compounds, quaternary compounds, and phenolic compounds.

Biguanides. Some of the more robust cyclodextrin-compatible antimicrobial halogenated compounds which can function as disinfectants/sanitizers as well as finish product preservatives (vide infra), and are useful in the compositions of the present invention include 1,1'-hexamethylene  
15 bis(5-(p-chlorophenyl)biguanide), commonly known as chlorhexidine, and its salts, e.g., with hydrochloric, acetic and gluconic acids. The digluconate salt is highly water-soluble, about 70% in water, and the diacetate salt has a solubility of about 1.8% in water. When chlorhexidine is used as a sanitizer in the present invention it is typically present at a level of from about 0.001% to about 0.4%, preferably from about 0.002% to about 0.3%, and more preferably from about 0.05% to  
20 about 0.2%, by weight of the usage composition. In some cases, a level of from about 1% to about 2% may be needed for virucidal activity.

Other useful biguanide compounds include Cosmocil® CQ®, Vantocil® IB, including poly (hexamethylene biguanide) hydrochloride. Other useful cationic antimicrobial agents include the bis-biguanide alkanes. Usable water soluble salts of the above are chlorides, bromides, sulfates,  
25 alkyl sulfonates such as methyl sulfonate and ethyl sulfonate, phenylsulfonates such as p-methylphenyl sulfonates, nitrates, acetates, gluconates, and the like.

Examples of suitable bis biguanide compounds are chlorhexidine: 1,6-bis-(2-ethylhexylbiguanidohexane)dihydrochloride; 1,6-di-(N<sub>1</sub>,N<sub>1</sub>'-phenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane tetrahydrochloride; 1,6-di-(N<sub>1</sub>,N<sub>1</sub>'-phenyl-N<sub>1</sub>,N<sub>1</sub>'-methyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane  
30 dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-o-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-2,6-dichlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane dihydrochloride; 1,6-di[N<sub>1</sub>,N<sub>1</sub>'-.beta.-(p-methoxyphenyl) diguanido-N<sub>5</sub>,N<sub>5</sub>']-hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-.alpha.-methyl-.beta.-phenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-p-nitrophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane dihydrochloride;.omega.:omega.'-di-(N<sub>1</sub>,N<sub>1</sub>'-phenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-di-n-

propylether dihydrochloride; omega:omega'-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-di-n-propylether tetrahydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-2,4-dichlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane tetrahydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-p-methylphenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-2,4,5-trichlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane tetrahydrochloride; 1,6-di[N<sub>1</sub>,N<sub>1</sub>'-alpha.-(p-chlorophenyl) ethyldiguanido-N<sub>5</sub>,N<sub>5</sub>'] hexane dihydrochloride; omega:omega'.di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')m-xylene dihydrochloride; 1,12-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') dodecane dihydrochloride; 1,10-di(N<sub>1</sub>,N<sub>1</sub>'-phenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-decane tetrahydrochloride; 1,12-di(N<sub>1</sub>,N<sub>1</sub>'-phenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') dodecane tetrahydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-o-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane tetrahydrochloride; ethylene bis (1-tolyl biguanide); ethylene bis (p-tolyl biguanide); ethylene bis(3,5-dimethylphenyl biguanide); ethylene bis(p-tert-amylphenyl biguanide); ethylene bis(nonylphenyl biguanide); ethylene bis (phenyl biguanide); ethylene bis (N-butylphenyl biguanide); ethylene bis (2,5-diethoxyphenyl biguanide); ethylene bis(2,4-dimethylphenyl biguanide); ethylene bis(o-diphenylbiguanide); ethylene bis(mixed amyl naphthyl biguanide); N-butyl ethylene bis(phenylbiguanide); trimethylene bis(o-tolyl biguanide); N-butyl trimethylene bis(phenyl biguanide); and the corresponding pharmaceutically acceptable salts of all of the above such as the acetates; gluconates; hydrochlorides; hydrobromides; citrates; bisulfites; fluorides; polymaleates; N-coconutalkylsarcosinates; phosphites; hypophosphites; perfluorooctanoates; silicates; sorbates; salicylates; maleates; tartrates; fumarates; ethylenediaminetetraacetates; iminodiacetates; cinnamates; thiocyanates; arginates; pyromellitates; tetracarboxybutyrates; benzoates; glutarates; monofluorophosphates; and perfluoropropionates, and mixtures thereof. Preferred antimicrobials from this group are 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-phenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane tetrahydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-o-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-2,6-dichlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-2,4-dichlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane tetrahydrochloride; 1,6-di[N<sub>1</sub>,N<sub>1</sub>'-alpha.-(p-chlorophenyl) ethyldiguanido-N<sub>5</sub>,N<sub>5</sub>'] hexane dihydrochloride; omega:omega'.di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')m-xylene dihydrochloride; 1,12-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') dodecane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-o-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane tetrahydrochloride; and mixtures thereof; more preferably, 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-o-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-2,6-dichlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-2,4-dichlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane tetrahydrochloride; 1,6-di[N<sub>1</sub>,N<sub>1</sub>'-alpha.-(p-chlorophenyl) ethyldiguanido-N<sub>5</sub>,N<sub>5</sub>'] hexane dihydrochloride; omega:omega'.di(N<sub>1</sub>,N<sub>1</sub>'-p-

chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')m-xylene dihydrochloride; 1,12-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') dodecane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-o-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane tetrahydrochloride; and mixtures thereof. As stated hereinbefore, the bis biguanide of choice is chlorhexidine its salts, e.g., digluconate, dihydrochloride, diacetate, and mixtures thereof.

Quaternary Compounds. A wide range of quaternary compounds can also be used as antimicrobial actives, in conjunction with the preferred surfactants, for compositions of the present invention that do not contain cyclodextrin. Non-limiting examples of useful quaternary compounds include: (1) benzalkonium chlorides and/or substituted benzalkonium chlorides such as commercially available Barquat<sup>®</sup> (available from Lonza), Maquat<sup>®</sup> (available from Mason), Variquat<sup>®</sup> (available from Witco/Sherex), and Hyamine<sup>®</sup> (available from Lonza); (2) di(C6-C14)alkyl quaternary such as Bardac<sup>®</sup> products of Lonza, (3) N-(3-chloroallyl) hexaminium chlorides such as Dowicide<sup>®</sup> and Dowicil<sup>®</sup> available from Dow; (4) benzethonium chloride such as Hyamine<sup>®</sup> 1622 from Rohm & Haas; (5) methylbenzethonium chloride represented by Hyamine<sup>®</sup> 10X supplied by Rohm & Haas, (6) cetylpyridinium chloride such as Cepacol chloride available from Merrell Labs. Examples of the preferred dialkyl quaternary compounds are di(C8-C12)dialkyl dimethyl ammonium chloride, such as didecyldimethylammonium chloride (Bardac 22), and dioctyldimethylammonium chloride (Bardac 2050). Typical concentrations for biocidal effectiveness of these quaternary compounds range from about 0.001% to about 0.8%, preferably from about 0.005% to about 0.3%, more preferably from about 0.01% to about 0.2%, and even more preferably from about 0.03% to about 0.1%, by weight of the usage composition. The corresponding concentrations for the concentrated compositions are from about 0.003% to about 2%, preferably from about 0.006% to about 1.2%, and more preferably from about 0.1% to about 0.8% by weight of the concentrated compositions.

The surfactants, when added to the antimicrobials tend to provide improved antimicrobial action. This is especially true for the siloxane surfactants, and especially when the siloxane surfactants are combined with the chlorhexidine antimicrobial actives.

#### (D). PERFUME

The odor absorbing composition of the present invention can also optionally provide a "scent signal" in the form of a pleasant odor which signals the removal of malodor from fabrics. The scent signal is designed to provide a fleeting perfume scent, and is not designed to be overwhelming or to be used as an odor masking ingredient. When perfume is added as a scent signal, it is added only at very low levels, e.g., from about 0% to about 0.5%, preferably from about

0.003% to about 0.3%, more preferably from about 0.005% to about 0.2%, by weight of the usage composition.

Perfume can also be added as a more intense odor in product and on surfaces. When stronger levels of perfume are preferred, relatively higher levels of perfume can be added. Any  
5 type of perfume can be incorporated into the composition of the present invention. It is essential, however, that the perfume be added at a level wherein even if all of the perfume in the composition were to complex with the cyclodextrin molecules, there will still be an effective level of uncomplexed cyclodextrin molecules present in the solution to provide adequate odor control. In  
10 order to reserve an effective amount of cyclodextrin molecules for odor control, perfume is typically present at a level wherein less than about 90% of the cyclodextrin complexes with the perfume, preferably less than about 50% of the cyclodextrin complexes with the perfume, more preferably, less than about 30% of the cyclodextrin complexes with the perfume, and most preferably, less than about 10% of the cyclodextrin complexes with the perfume. The cyclodextrin to perfume weight ratio should be greater than about 8:1, preferably greater than about 10:1, more  
15 preferably greater than about 20:1, even more preferably greater than 40:1 and most preferably greater than about 70:1.

Preferably the perfume is hydrophilic and is composed predominantly of ingredients selected from two groups of ingredients, namely, (a) hydrophilic ingredients having a ClogP of less than about 3.5, more preferably less than about 3.0, and (b) ingredients having significant low  
20 detection threshold, and mixtures thereof. Typically, at least about 50%, preferably at least about 60%, more preferably at least about 70%, and most preferably at least about 80% by weight of the perfume is composed of perfume ingredients of the above groups (a) and (b). For these preferred perfumes, the cyclodextrin to perfume weight ratio is typically of from about 2:1 to about 200:1; preferably from about 4:1 to about 100:1, more preferably from about 6:1 to about 50:1, and even  
25 more preferably from about 8:1 to about 30:1.

(a). Hydrophilic Perfume Ingredients

The hydrophilic perfume ingredients are more soluble in water, have less of a tendency to complex with the cyclodextrins, and are more available in the odor absorbing composition than the ingredients of conventional perfumes. The degree of hydrophobicity of a perfume ingredient can  
30 be correlated with its octanol/water partition coefficient P. The octanol/water partition coefficient of a perfume ingredient is the ratio between its equilibrium concentration in octanol and in water. A perfume ingredient with a greater partition coefficient P is considered to be more hydrophobic. Conversely, a perfume ingredient with a smaller partition coefficient P is considered to be more hydrophilic. Since the partition coefficients of the perfume ingredients normally have high values,

they are more conveniently given in the form of their logarithm to the base 10, logP. Thus the preferred perfume hydrophilic perfume ingredients of this invention have logP of about 3.5 or smaller, preferably of about 3.0 or smaller.

The logP of many perfume ingredients have been reported; for example, the Pomona92 database, available from Daylight Chemical Information Systems, Inc. (Daylight CIS), Irvine, California, contains many, along with citations to the original literature. However, the logP values are most conveniently calculated by the "CLOGP" program, also available from Daylight CIS. This program also lists experimental logP values when they are available in the Pomona92 database. The "calculated logP" (ClogP) is determined by the fragment approach of Hansch and Leo (cf., A. Leo, in Comprehensive Medicinal Chemistry, Vol. 4, C. Hansch, P. G. Sammens, J. B. Taylor and C. A. Ramsden, Eds., p. 295, Pergamon Press, 1990, incorporated herein by reference). The fragment approach is based on the chemical structure of each perfume ingredient, and takes into account the numbers and types of atoms, the atom connectivity, and chemical bonding. The ClogP values, which are the most reliable and widely used estimates for this physicochemical property, are used instead of the experimental logP values in the selection of perfume ingredients which are useful in the present invention.

Non-limiting examples of the more preferred hydrophilic perfume ingredients are allyl amyl glycolate, allyl caproate, amyl acetate, amyl propionate, anisic aldehyde, anisyl acetate, anisole, benzaldehyde, benzyl acetate, benzyl acetone, benzyl alcohol, benzyl formate, benzyl iso valerate, benzyl propionate, beta gamma hexenol, calone, camphor gum, laevo-carveol, d-carvone, laevo-carvone, cinnamic alcohol, cinnamyl acetate, cinnamic alcohol, cinnamyl formate, cinnamyl propionate, cis-jasmone, cis-3-hexenyl acetate, coumarin, cuminic alcohol, cuminic aldehyde, Cyclal C, cyclogalbanate, dihydroeugenol, dihydro isojasmonate, dimethyl benzyl carbinol, dimethyl benzyl carbonyl acetate, ethyl acetate, ethyl aceto acetate, ethyl amyl ketone, ethyl anthranilate, ethyl benzoate, ethyl butyrate, ethyl cinnamate, ethyl hexyl ketone, ethyl maltol, ethyl-2-methyl butyrate, ethyl methylphenyl glycidate, ethyl phenyl acetate, ethyl salicylate, ethyl vanillin, eucalyptol, eugenol, eugenyl acetate, eugenyl formate, eugenyl methyl ether, fenchyl alcohol, flor acetate (tricyclo decenyl acetate), fructose, frutene (tricyclo decenyl propionate), geraniol, geranyl oxyacetaldehyde, heliotropin, hexenol, hexenyl acetate, hexyl acetate, hexyl formate, hinokitol, hydratropic alcohol, hydroxycitronellal, hydroxycitronellal diethyl acetal, hydroxycitronellol, indole, isoamyl alcohol, iso cyclo citral, isoeugenol, isoeugenyl acetate, isomenthone, isopulegyl acetate, isoquinoline, keone, ligustral, linalool, linalool oxide, linalyl formate, lyral, menthone, methyl acetophenone, methyl amyl ketone, methyl anthranilate, methyl benzoate, methyl benzyl acetate, methyl cinnamate, methyl dihydrojasmonate, methyl eugenol,



methyl heptenone, methyl heptene carbonate, methyl heptyl ketone, methyl hexyl ketone, methyl isobutenyl tetrahydropyran, methyl-N-methyl anthranilate, methyl beta naphthyl ketone, methyl phenyl carbonyl acetate, methyl salicylate, nerol, nonalactone, octalactone, octyl alcohol (octanol-2), para-anisic aldehyde, para-cresol, para-cresyl methyl ether, para hydroxy phenyl butanone, para-methoxy acetophenone, para-methyl acetophenone, phenoxy ethanol, phenoxyethyl propionate, phenyl acetaldehyde, phenylacetaldehyde diethyl ether, phenylethyl oxyacetaldehyde, phenyl ethyl acetate, phenyl ethyl alcohol, phenyl ethyl dimethyl carbinol, prenyl acetate, propyl butyrate, pulegone, rose oxide, safrole, terpineol, vanillin, viridine, and mixtures thereof.

Nonlimiting examples of other preferred hydrophilic perfume ingredients which can be used in perfume compositions of this invention are allyl heptoate, amyl benzoate, anethole, benzophenone, carvacrol, citral, citronellol, citronellyl nitrile, cyclohexyl ethyl acetate, cymal, 4-decenal, dihydro isojasmonate, dihydro myrcenol, ethyl methyl phenyl glycidate, fenchyl acetate, florhydral, gamma-nonolactone, geranyl formate, geranyl nitrile, hexenyl isobutyrate, alpha-ionone, isobornyl acetate, isobutyl benzoate, isononyl alcohol, isomenthol, para-isopropyl phenylacetaldehyde, isopulegol, linalyl acetate, 2-methoxy naphthalene, menthyl acetate, methyl chavicol, musk ketone, beta naphthol methyl ether, neral, nonyl aldehyde, phenyl heptanol, phenyl hexanol, terpinyl acetate, Veratrol, yara-yara, and mixtures thereof.

The preferred perfume compositions used in the present invention contain at least 4 different hydrophilic perfume ingredients, preferably at least 5 different hydrophilic perfume ingredients, more preferably at least 6 different hydrophilic perfume ingredients, and even more preferably at least 7 different hydrophilic perfume ingredients. Most common perfume ingredients which are derived from natural sources are composed of a multitude of components. When each such material is used in the formulation of the preferred perfume compositions of the present invention, it is counted as one single ingredient, for the purpose of defining the invention.

(b). Low Odor Detection Threshold Perfume Ingredient

The odor detection threshold of an odorous material is the lowest vapor concentration of that material which can be olfactorily detected. The odor detection threshold and some odor detection threshold values are discussed in, e.g., "Standardized Human Olfactory Thresholds", M. Devos et al. IRI. Press at Oxford University Press, 1990, and "Compilation of Odor and Taste Threshold Values Data", F. A. Fazzalari, editor, ASTM Data Series DS 48A, American Society for Testing and Materials, 1978, both of said publications being incorporated by reference. The use of small amounts of perfume ingredients that have low odor detection threshold values can improve perfume odor character, even though they are not as hydrophilic as perfume ingredients of group (a) which are given hereinabove. Perfume ingredients that do not belong to group (a) above, but have a

significantly low detection threshold, useful in the composition of the present invention, are selected from the group consisting of ambrox, bacdanol, benzyl salicylate, butyl anthranilate, cetalex, damascenone, alpha-damascone, gamma-dodecalactone, ebanol, herbavert, cis-3-hexenyl salicylate, alpha-ionone, beta-ionone, alpha-isomethylionone, linal, methyl nonyl ketone, gamma-undecalactone, undecylenic aldehyde, and mixtures thereof. These materials are preferably present at low levels in addition to the hydrophilic ingredients of group (a), typically less than about 20%, preferably less than about 15%, more preferably less than about 10%, by weight of the total perfume compositions of the present invention. However, only low levels are required to provide an effect.

There are also hydrophilic ingredients of group (a) that have a significantly low detection threshold, and are especially useful in the composition of the present invention. Examples of these ingredients are allyl amyl glycolate, anethole, benzyl acetone, calone, cinnamic alcohol, coumarin, cyclogalbanate, Cyclal C, cymal, 4-decenal, dihydro isojasmonate, ethyl anthranilate, ethyl-2-methyl butyrate, ethyl methylphenyl glycidate, ethyl vanillin, eugenol, flor acetate, florhydral, fructose, frutene, heliotropin, ketone, indole, iso cyclo citral, isoeugenol, linal, methyl heptene carbonate, linalool, methyl anthranilate, methyl dihydrojasmonate, methyl isobutenyl tetrahydropyran, methyl beta naphthyl ketone, beta naphthol methyl ether, nerol, para-anisic aldehyde, para hydroxy phenyl butanone, phenyl acetaldehyde, vanillin, and mixtures thereof. Use of low odor detection threshold perfume ingredients minimizes the level of organic material that is released into the atmosphere.

(E). LOW MOLECULAR WEIGHT POLYOLS

Low molecular weight polyols with relatively high boiling points, as compared to water, such as ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol and/or glycerol are preferred optional ingredients for improving odor control performance of the composition of the present invention. Not to be bound by theory, it is believed that the incorporation of a small amount of low molecular weight glycols into the composition of the present invention enhances the formation of the cyclodextrin inclusion complexes as the fabric dries.

It is believed that the polyols' ability to remain on the fabric for a longer period of time than water, as the fabric dries allows it to form ternary complexes with the cyclodextrin and some malodorous molecules. The addition of the glycols is believed to fill up void space in the cyclodextrin cavity that is unable to be totally filled by some malodor molecules of relatively smaller sizes. Preferably the glycol used is glycerine, ethylene glycol, propylene glycol, dipropylene glycol or mixtures thereof, more preferably ethylene glycol and propylene glycol.

Cyclodextrins prepared by processes that result in a level of such polyols are highly desirable, since they can be used without removal of the polyols.

Some polyols, e.g., dipropylene glycol, are also useful to facilitate the solubilization of some perfume ingredients in the composition of the present invention.

5 Typically, glycol is added to the composition of the present invention at a level of from about 0.01% to about 3%, by weight of the composition, preferably from about 0.05% to about 1%, more preferably from about 0.1% to about 0.5%, by weight of the composition. The preferred weight ratio of low molecular weight polyol to cyclodextrin is from about 2:1,000 to about 20:100, more preferably from about 3:1,000 to about 15:100, even more preferably from about 5:1,000 to  
10 about 10:100, and most preferably from about 1:100 to about 7:100.

#### (F). OPTIONAL AMINOCARBOXYLATE CHELATORS

Chelators, e.g., ethylenediaminetetraacetic acid (EDTA), hydroxyethylene-  
diaminetriacetic acid, diethylenetriaminepentaacetic acid, and other aminocarboxylate chelators,  
and mixtures thereof, and their salts, and mixtures thereof, can optionally be used to increase  
15 antimicrobial and preservative effectiveness against Gram-negative bacteria, especially Pseudomonas species. Although sensitivity to EDTA and other aminocarboxylate chelators is mainly a characteristic of Pseudomonas species, other bacterial species highly susceptible to chelators include Achromobacter, Alcaligenes, Azotobacter, Escherichia, Salmonella, Spirillum,  
and Vibrio. Other groups of organisms also show increased sensitivities to these chelators,  
20 including fungi and yeasts. Furthermore, aminocarboxylate chelators can help, e.g., maintaining product clarity, protecting fragrance and perfume components, and preventing rancidity and off odors.

Although these aminocarboxylate chelators may not be potent biocides in their own right, they function as potentiators for improving the performance of other antimicrobials/preservatives in  
25 the compositions of the present invention. Aminocarboxylate chelators can potentiate the performance of many of the cationic, anionic, and nonionic antimicrobials/preservatives, phenolic compounds, and isothiazolinones, that are used as antimicrobials/preservatives in the composition of the present invention. Nonlimiting examples of cationic antimicrobials/preservatives potentiated by aminocarboxylate chelators in solutions are chlorhexidine salts (including digluconate, diacetate,  
30 and dihydrochloride salts), and Quaternium-15, also known as Dowicil 200, Dowicide Q, Preventol D1, benalkonium chloride, cetrimonium, myristalkonium chloride, cetylpyridinium chloride, lauryl pyridinium chloride, and the like. Nonlimiting examples of useful anionic antimicrobials/preservatives which are enhanced by aminocarboxylate chelators are sorbic acid and potassium sorbate. Nonlimiting examples of useful nonionic antimicrobials/preservatives which

are potentiated by aminocarboxylate chelators are DMDM hydantoin, phenethyl alcohol, monolaurin, imidazolidinyl urea, and Bronopol (2-bromo-2-nitropropane-1,3-diol).

Examples of useful phenolic antimicrobials/preservatives potentiated by these chelators are chloroxylenol, phenol, tert-butyl hydroxyanisole, salicylic acid, resorcinol, and sodium o-phenyl phenate. Nonlimiting examples of isothiazolinone antimicrobials/preservatives which are enhanced by aminocarboxylate chelators are Kathon, Proxel and Promexal.

The optional chelators are present in the compositions of this invention at levels of, typically, from about 0.01% to about 0.3%, more preferably from about 0.02% to about 0.1%, most preferably from about 0.02% to about 0.05% by weight of the usage compositions to provide antimicrobial efficacy in this invention.

Free, uncomplexed aminocarboxylate chelators are required to potentiate the efficacy of the antimicrobials. Thus, when excess alkaline earth (especially calcium and magnesium) and transitional metals (iron, manganese, copper, and others) are present, free chelators are not available and antimicrobial potentiation is not observed. In the case where significant water hardness or transitional metals are available or where product esthetics require a specified chelator level, higher levels may be required to allow for the availability of free, uncomplexed aminocarboxylate chelators to function as antimicrobial/preservative potentiators.

#### (G) METAL SALTS

Optionally, but highly preferred, the present invention can include metallic salts for added odor absorption and/or antimicrobial benefit for the cyclodextrin solution. The metallic salts are selected from the group consisting of copper salts, zinc salts, and mixtures thereof.

Copper salts have some antimicrobial benefits. Specifically, cupric abietate acts as a fungicide, copper acetate acts as a mildew inhibitor, cupric chloride acts as a fungicide, copper lactate acts as a fungicide, and copper sulfate acts as a germicide. Copper salts also possess some malodor control abilities. See U. S. Pat. No. 3,172,817, Leupold, et al., which discloses deodorizing compositions for treating disposable articles, comprising at least slightly water-soluble salts of acylacetone, including copper salts and zinc salts, all of said patents are incorporated herein by reference.

The preferred zinc salts possess malodor control abilities. Zinc has been used most often for its ability to ameliorate malodor, e.g., in mouth wash products, as disclosed in U.S. Pat. Nos. 4,325,939, issued Apr. 20, 1982 and 4,469,674, issued Sept. 4, 1983, to N. B. Shah, et al., all of which are incorporated herein by reference. Highly-ionized and soluble zinc salts such as zinc chloride, provide the best source of zinc ions. Zinc borate functions as a fungistat and a mildew inhibitor, zinc caprylate functions as a fungicide, zinc chloride provides antiseptic and deodorant

benefits, zinc ricinoleate functions as a fungicide, zinc sulfate heptahydrate functions as a fungicide and zinc undecylenate functions as a fungistat.

Preferably the metallic salts are water-soluble zinc salts, copper salts or mixtures thereof, and more preferably zinc salts, especially  $\text{ZnCl}_2$ . These salts are preferably present in the present invention primarily to absorb amine and sulfur-containing compounds that have molecular sizes too small to be effectively complexed with the cyclodextrin molecules. Low molecular weight sulfur-containing materials, e.g., sulfide and mercaptans, are components of many types of malodors, e.g., food odors (garlic, onion), body/perspiration odor, breath odor, etc. Low molecular weight amines are also components of many malodors, e.g., food odors, body odors, urine, etc.

When metallic salts are added to the composition of the present invention they are typically present at a level of from about 0.1% to about 10%, preferably from about 0.2% to about 8%, more preferably from about 0.3% to about 5% by weight of the usage composition. When zinc salts are used as the metallic salt, and a clear solution is desired, it is preferable that the pH of the solution is adjusted to less than about 7, more preferably less than about 6, most preferably, less than about 5, in order to keep the solution clear.

#### (H). HUMECTANT

Optionally, the composition can contain a small amount of humectant, such as glycerine, or inorganic hygroscopic material, to provide slower drying for clothing/fabrics treated with the compositions, to allow time for any wrinkles to disappear when the clothing/fabrics are hung to dry. For most purposes, this is preferably not present, since normally the user wants the clothing/fabrics to dry sooner.

When a humectant is used, it is present in the composition in an amount of from 0.01% to 10%, preferably from 0.05% to 5%, more preferably from 0.1% to 2% by weight of the aqueous composition.

#### 25 (I) CARRIER

Aqueous solutions are preferred for odor control. The dilute aqueous solution provides the maximum separation of cyclodextrin molecules on the fabric and thereby maximizes the chance that an odor molecule will interact with a cyclodextrin molecule.

The preferred carrier of the present invention is water. The water which is used can be distilled, deionized, or tap water. Water not only serves as the liquid carrier for the cyclodextrins, but it also facilitates the complexation reaction between the cyclodextrin molecules and any malodorous molecules that are on the fabric when it is treated. It has recently been discovered that water has an unexpected odor controlling effect of its own. It has been discovered that the intensity of the odor generated by some polar, low molecular weight organic amines, acids, and mercaptans

is reduced when the odor-contaminated fabrics are treated with an aqueous solution. Not to be bound by theory, it is believed that water solubilizes and depresses the vapor pressure of these polar, low molecular weight organic molecules, thus reducing their odor intensity.

(J) OTHER OPTIONAL INGREDIENTS

5           The composition of the present invention can optionally contain adjunct odor-controlling materials, enzymes, chelating agents, antistatic agents, insect and moth repelling agents, colorants, especially bluing agents, antioxidants, and mixtures thereof in addition to the cyclodextrin molecules. The total level of optional ingredients is low, preferably less than about 5%, more preferably less than about 3%, and even more preferably less than about 2%, by weight of the usage  
10       composition. These optional ingredients exclude the other ingredients specifically mentioned hereinbefore. Incorporating adjunct odor-controlling materials can enhance the capacity of the cyclodextrin to control odors as well as broaden the range of odor types and molecule sizes which can be controlled. Such materials include, for example, metallic salts, water-soluble cationic and anionic polymers, zeolites, water-soluble bicarbonate salts, and mixtures thereof.

15       (1) Water-Soluble Polymers

Some water-soluble polymers, e.g., water-soluble cationic polymer and water-soluble anionic polymers can be used in the composition of the present invention to provide additional odor control benefits.

a. Cationic polymers, e.g., polyamines

20       Water-soluble cationic polymers, e.g., those containing amino functionalities, amido functionalities, and mixtures thereof, are useful in the present invention to control certain acid-type odors.

b. Anionic polymers, e.g., polyacrylic acid

25       Water-soluble anionic polymers, e.g., polyacrylic acids and their water-soluble salts are useful in the present invention to control certain amine-type odors. Preferred polyacrylic acids and their alkali metal salts have an average molecular weight of less than about 20,000, more preferably less than 5,000. Polymers containing sulfonic acid groups, phosphoric acid groups, phosphonic acid groups, and their water-soluble salts, and mixtures thereof, and mixtures with carboxylic acid and carboxylate groups, are also suitable.

30       Water-soluble polymers containing both cationic and anionic functionalities are also suitable. Examples of these polymers are given in U.S. Pat. 4,909,986, issued March 20, 1990 to N. Kobayashi and A. Kawazoe, incorporated herein by reference. Another example of water-soluble polymers containing both cationic and anionic functionalities is a copolymer of dimethyldiallyl

ammonium chloride and acrylic acid, commercially available under the trade name Merquat 280® from Calgon.

When a water-soluble polymer is used it is typically present at a level of from about 0.001% to about 3%, preferably from about 0.005% to about 2%, more preferably from about 0.01% to about 1%, and even more preferably from about 0.05% to about 0.5%, by weight of the usage composition.

(2). Soluble Carbonate and/or Bicarbonate Salts

Water-soluble alkali metal carbonate and/or bicarbonate salts, such as sodium bicarbonate, potassium bicarbonate, potassium carbonate, cesium carbonate, sodium carbonate, and mixtures thereof can be added to the composition of the present invention in order to help to control certain acid-type odors. Preferred salts are sodium carbonate monohydrate, potassium carbonate, sodium bicarbonate, potassium bicarbonate, and mixtures thereof. When these salts are added to the composition of the present invention, they are typically present at a level of from about 0.1% to about 5%, preferably from about 0.2% to about 3%, more preferably from about 0.3% to about 2%, by weight of the composition. When these salts are added to the composition of the present invention it is preferably that incompatible metal salts not be present in the invention. Preferably, when these salts are used the composition should be essentially free of zinc and other incompatible metal ions, e.g., Ca, Fe, Ba, etc. which form water-insoluble salts.

(3). Enzymes

Enzymes can be used to control certain types of malodor, especially malodor from urine and other types of excretions, including regurgitated materials. Proteases are especially desirable. The activity of commercial enzymes depends very much on the type and purity of the enzyme being considered. Enzymes that are water soluble proteases like pepsin, trypsin, ficin, bromelin, papain, rennin, and mixtures thereof are particularly useful.

Enzymes are normally incorporated at levels sufficient to provide up to about 5 mg by weight, preferably from about 0.001 mg to about 3 mg, more preferably from about 0.002 mg to about 1 mg, of active enzyme per gram of the aqueous compositions. Stated otherwise, the aqueous compositions herein can comprise from about 0.0001% to about 0.5%, preferably from about 0.001% to about 0.3%, more preferably from about 0.005% to about 0.2% by weight of a commercial enzyme preparation. Protease enzymes are usually present in such commercial preparations at levels sufficient to provide from 0.0005 to 0.1 Anson units (AU) of activity per gram of aqueous composition.

Nonlimiting examples of suitable, commercially available, water soluble proteases are pepsin, trypsin, ficin, bromelin, papain, rennin, and mixtures thereof. Papain can be isolated, e.g.,

from papaya latex, and is available commercially in the purified form of up to, e.g., about 80% protein, or cruder, technical grade of much lower activity. Other suitable examples of proteases are the subtilisins which are obtained from particular strains of *B. subtilis* and *B. licheniformis*. Another suitable protease is obtained from a strain of *Bacillus*, having maximum activity throughout the pH range of 8-12, developed and sold by Novo Industries A/S under the registered trade name ESPERASE®. The preparation of this enzyme and analogous enzymes is described in British Patent Specification No. 1,243,784 of Novo. Proteolytic enzymes suitable for removing protein-based stains that are commercially available include those sold under the trade names ALCALASE® and SAVINASE® by Novo Industries A/S (Denmark) and MAXATASE® by International Bio-Synthetics, Inc. (The Netherlands). Other proteases include Protease A (see European Patent Application 130,756, published January 9, 1985); Protease B (see European Patent Application Serial No. 87303761.8, filed April 28, 1987, and European Patent Application 130,756, Bott et al, published January 9, 1985); and proteases made by Genencor International, Inc., according to one or more of the following patents: Caldwell et al, U.S. Patent Nos. 5,185,258, 5,204,015 and 5,244,791.

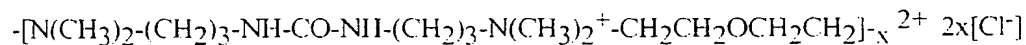
A wide range of enzyme materials and means for their incorporation into liquid compositions are also disclosed in U.S. Patent 3,553,139, issued January 5, 1971 to McCarty et al. Enzymes are further disclosed in U.S. Patent 4,101,457, Place et al, issued July 18, 1978, and in U.S. Patent 4,507,219, Hughes, issued March 26, 1985. Other enzyme materials useful for liquid formulations, and their incorporation into such formulations, are disclosed in U.S. Patent 4,261,868, Hora et al, issued April 14, 1981. Enzymes can be stabilized by various techniques, e.g., those disclosed and exemplified in U.S. Patent 3,600,319, issued August 17, 1971 to Gedge, et al., European Patent Application Publication No. 0 199 405, Application No. 86200586.5, published October 29, 1986, Venegas, and in U.S. Patent 3,519,570. All of the above patents and applications are incorporated herein, at least in pertinent part.

Enzyme-polyethylene glycol conjugates are also preferred. Such polyethylene glycol (PEG) derivatives of enzymes, wherein the PEG or alkoxy-PEG moieties are coupled to the protein molecule through, e.g., secondary amine linkages. Suitable derivatization decreases immunogenicity, thus minimizes allergic reactions, while still maintains some enzymatic activity. An example of protease-PEG's is PEG-subtilisin Carlsberg from *B. licheniformis* coupled to methoxy-PEGs through secondary amine linkage, and is available from Sigma-Aldrich Corp., St Louis, Missouri.

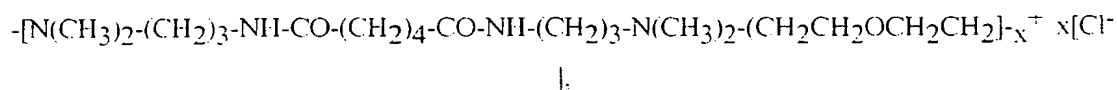
(4). Antistatic Agents



The composition of the present invention can optionally contain an effective amount of antistatic agent to provide the treated clothes with in-wear static control. Preferred antistatic agents are those that are water soluble in at least an effective amount, such that the composition remains a clear solution, and are compatible with cyclodextrin. Nonlimiting examples of these antistatic agents are polymeric quaternary ammonium salts, such as polymers conforming to the general formula:



available under the trade name Mirapol A-15<sup>®</sup> from Rhône-Poulenc, and



available under the trade name Mirapol AD-1<sup>®</sup> from Rhône-Poulenc; quaternized polyethyleneimines; vinylpyrrolidone/methacrylamidopropyltrimethylammonium chloride copolymer, available under the trade name Gafquat HS-100<sup>®</sup> from GAF; trithonium hydrolyzed collagen ethosulfate, available under the trade name Quat-Pro E<sup>®</sup> from Maybrook; neutralized sulfonated polystyrene, available, e.g., under the trade name Versa TL-130<sup>®</sup> from Alco Chemical; neutralized sulfonated styrene/maleic anhydride copolymers, available, e.g., under the trade name Versa TL-4<sup>®</sup> from Alco Chemical; polyethylene glycols; and mixtures thereof.

It is preferred that a no foaming, or low foaming, agent is used, to avoid foam formation during fabric treatment. It is also preferred that polyethoxylated agents such as polyethylene glycol or Variquat 66<sup>®</sup> are not used when alpha-cyclodextrin is used. The polyethoxylate groups have a strong affinity to, and readily complex with, alpha-cyclodextrin which in turn depletes the uncomplexed cyclodextrin available for odor control.

When an antistatic agent is used it is typically present at a level of from about 0.05% to about 10%, preferably from about 0.1% to about 5%, more preferably from about 0.3% to about 3%, by weight of the usage composition.

#### (5). Insect and/or Moth Repelling Agent

The composition of the present invention can optionally contain an effective amount of insect and/or moth repelling agents. Typical insect and moth repelling agents are pheromones, such as anti-aggregation pheromones, and other natural and/or synthetic ingredients. Preferred insect and moth repellent agents useful in the composition of the present invention are perfume ingredients, such as citronellol, citronellal, citral, linalool, cedar extract, geranium oil, sandalwood oil, 2-(diethylphenoxy)ethanol, 1-dodecene, etc. Other examples of insect and/or moth repellents useful in the composition of the present invention are disclosed in U.S. Pat. Nos. 4,449,987, 4,693,890, 4,696,676, 4,933,371, 5,030,660, 5,196,200, and in "Semio Activity of Flavor and

Fragrance Molecules on Various Insect Species". B.D. Mookherjee et al., published in Bioactive Volatile Compounds from Plants, ASC Symposium Series 525, R. Teranishi, R.G. Buttery, and H. Sugisawa, 1993, pp. 35-48, all of said patents and publications being incorporated herein by reference. When an insect and/or moth repellent is used it is typically present at a level of from about 0.005% to about 3%, by weight of the usage composition.

(6). Additional Odor Absorbers

When the clarity of the solution is not needed, and the solution is not sprayed on fabrics, other optional odor absorbing materials, e.g., zeolites and/or activated carbon, can also be used.

(a). Zeolites

A preferred class of zeolites is characterized as "intermediate" silicate/aluminate zeolites. The intermediate zeolites are characterized by  $\text{SiO}_2/\text{AlO}_2$  molar ratios of less than about 10. Preferably the molar ratio of  $\text{SiO}_2/\text{AlO}_2$  ranges from about 2 to about 10. The intermediate zeolites have an advantage over the "high" zeolites. The intermediate zeolites have a higher affinity for amine-type odors, they are more weight efficient for odor absorption because they have a larger surface area, and they are more moisture tolerant and retain more of their odor absorbing capacity in water than the high zeolites. A wide variety of intermediate zeolites suitable for use herein are commercially available as Valfor® CP301-68, Valfor® 300-63, Valfor® CP300-35, and Valfor® CP300-56, available from PQ Corporation, and the CBV100® series of zeolites from Conteka.

Zeolite materials marketed under the trade name Abscents® and Smellrite®, available from The Union Carbide Corporation and UOP are also preferred. These materials are typically available as a white powder in the 3-5 micron particle size range. Such materials are preferred over the intermediate zeolites for control of sulfur-containing odors, e.g., thiols, mercaptans.

(b). Activated Carbon

The carbon material suitable for use in the present invention is the material well known in commercial practice as an absorbent for organic molecules and/or for air purification purposes. Often, such carbon material is referred to as "activated" carbon or "activated" charcoal. Such carbon is available from commercial sources under such trade names as; Calgon-Type CPG®, Type PCB®, Type SGL®, Type CAL®, and Type OL®.

(7). Colorant

Colorants and dyes, especially bluing agents, can be optionally added to the odor absorbing compositions for visual appeal and performance impression. When colorants are used, they are used at extremely low levels to avoid fabric staining. Preferred colorants for use in the present compositions are highly water-soluble dyes, e.g., Liquitint® dyes available from Milliken Chemical Co. Non-limiting examples of suitable dyes are, Liquitint Blue HP®, Liquitint Blue

65<sup>®</sup>, Liquitint Patent Blue<sup>®</sup>, Liquitint Royal Blue<sup>®</sup>, Liquitint Experimental Yellow 8949-43<sup>®</sup>, Liquitint Green HMC<sup>®</sup>, Liquitint Yellow II<sup>®</sup>, and mixtures thereof, preferably Liquitint Blue HP<sup>®</sup>, Liquitint Blue 65<sup>®</sup>, Liquitint Patent Blue<sup>®</sup>, Liquitint Royal Blue<sup>®</sup>, Liquitint Experimental Yellow 8949-43<sup>®</sup>, and mixtures thereof.

5 (8). Optional Preservative

Optionally, but preferably, solubilized, water-soluble, antimicrobial preservative can be added to the composition of the present invention if the antimicrobial material C. is not sufficient, or is not present, because cyclodextrin molecules are made up of varying numbers of glucose units which can make them a prime breeding ground for certain microorganisms, especially when in  
10 aqueous compositions. This drawback can lead to the problem of storage stability of cyclodextrin solutions for any significant length of time. Contamination by certain microorganisms with subsequent microbial growth can result in an unsightly and/or malodorous solution. Because microbial growth in cyclodextrin solutions is highly objectionable when it occurs, it is highly preferable to include a solubilized, water-soluble, antimicrobial preservative, which is effective for  
15 inhibiting and/or regulating microbial growth in order to increase storage stability of the preferably clear, aqueous odor-absorbing solution containing water-soluble cyclodextrin.

Typical microorganisms that can be found in cyclodextrin supplies and whose growth can be found in the presence of cyclodextrin in aqueous cyclodextrin solutions include bacteria, e.g., Bacillus thuringiensis (cereus group) and Bacillus sphaericus; and fungi, e.g., Aspergillus ustus.  
20 Bacillus sphaericus is one of the most numerous members of Bacillus species in soils. Aspergillus ustus is common in grains and flours which are raw materials to produce cyclodextrins. Microorganisms such as Escherichia coli and Pseudomonas aeruginosa are found in some water sources, and can be introduced during the preparation of cyclodextrin solutions. Other Pseudomonas species, such as P. cepacia, are typical microbial contaminants in surfactant  
25 manufacturing facilities and may readily contaminate packed finished products. Typical other bacterial contaminants may include Burkholderia, Enterobacter and Gluconobacter species. Representative fungal species which may be associated with agricultural soils, crops and in the case of this invention, corn products such as cyclodextrins include Aspergillus, Absidia, Penicillium, Paccilomyces, and other species.

30 It is preferable to use a broad spectrum preservative, e.g., one that is effective on both bacteria (both gram positive and gram negative) and fungi. A limited spectrum preservative, e.g., one that is only effective on a single group of microorganisms, e.g., fungi, can be used in combination with a broad spectrum preservative or other limited spectrum preservatives with complimentary and/or supplementary activity. A mixture of broad spectrum preservatives can also

be used. In some cases where a specific group of microbial contaminants is problematic (such as Gram negatives), aminocarboxylate chelators may be used alone or as potentiators in conjunction with other preservatives. These chelators which include, e.g., ethylenediaminetetraacetic acid (EDTA), hydroxyethylenediaminetriacetic acid, diethylenetriaminepentaacetic acid, and other aminocarboxylate chelators, and mixtures thereof, and their salts, and mixtures thereof, can increase preservative effectiveness against Gram-negative bacteria, especially *Pseudomonas* species.

Antimicrobial preservatives useful in the present invention include biocidal compounds, i.e., substances that kill microorganisms, or biostatic compounds, i.e., substances that inhibit and/or regulate the growth of microorganisms.

Preferred antimicrobial preservatives are those that are water-soluble and are effective at low levels because the organic preservatives can form inclusion complexes with the cyclodextrin molecules and compete with the malodorous molecules for the cyclodextrin cavities, thus rendering the cyclodextrins ineffective as odor controlling actives. Water-soluble preservatives useful in the present invention are those that have a solubility in water of at least about 0.3 g per 100 ml of water, i.e., greater than about 0.3% at room temperature, preferably greater than about 0.5% at room temperature. These types of preservatives have a lower affinity to the cyclodextrin cavity, at least in the aqueous phase, and are therefore more available to provide antimicrobial activity. Preservatives with a water-solubility of less than about 0.3% and a molecular structure that readily fits into the cyclodextrin cavity, have a greater tendency to form inclusion complexes with the cyclodextrin molecules, thus rendering the preservative less effective to control microbes in the cyclodextrin solution. Therefore, many well known preservatives such as short chain alkyl esters of p-hydroxybenzoic acid, commonly known as parabens; N-(4-chlorophenyl)-N'-(3,4-dichlorophenyl) urea, also known as 3,4,4'-trichlorocarbanilide or triclocarban; 2,4,4'-trichloro-2'-hydroxy diphenyl ether, commonly known as triclosan are not preferred in the present invention since they are relatively ineffective when used in conjunction with cyclodextrin.

The water-soluble antimicrobial preservative in the present invention is included at an effective amount. The term "effective amount" as herein defined means a level sufficient to prevent spoilage, or prevent growth of inadvertently added microorganisms, for a specific period of time. In other words, the preservative is not being used to kill microorganisms on the surface onto which the composition is deposited in order to eliminate odors produced by microorganisms. Instead, it is preferably being used to prevent spoilage of the cyclodextrin solution in order to increase the shelf-life of the composition. Preferred levels of preservative are from about 0.0001% to about 0.5%, more preferably from about 0.0002% to about 0.2%, most preferably from about 0.0003% to about 0.1%, by weight of the usage composition.

In order to reserve most of the cyclodextrins for odor control, the cyclodextrin to preservative molar ratio should be greater than about 5:1, preferably greater than about 10:1, more preferably greater than about 50:1, even more preferably greater than about 100:1.

The preservative can be any organic preservative material which will not cause damage to fabric appearance, e.g., discoloration, coloration, bleaching. Preferred water-soluble preservatives include organic sulfur compounds, halogenated compounds, cyclic organic nitrogen compounds, low molecular weight aldehydes, quaternary ammonium compounds, dehydroacetic acid, phenyl and phenolic compounds, and mixtures thereof.

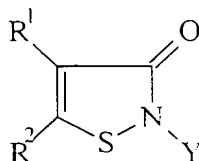
The following are non-limiting examples of preferred water-soluble preservatives for use in the present invention.

(A). Organic Sulfur Compounds

Preferred water-soluble preservatives for use in the present invention are organic sulfur compounds. Some non-limiting examples of organic sulfur compounds suitable for use in the present invention are:

(a) 3-Isothiazolone Compounds

A preferred preservative is an antimicrobial, organic preservative containing 3-isothiazolone groups having the formula:



wherein

Y is an unsubstituted alkyl, alkenyl, or alkynyl group of from about 1 to about 18 carbon atoms, an unsubstituted or substituted cycloalkyl group having from about a 3 to about a 6 carbon ring and up to 12 carbon atoms, an unsubstituted or substituted aralkyl group of up to about 10 carbon atoms, or an unsubstituted or substituted aryl group of up to about 10 carbon atoms;

R<sup>1</sup> is hydrogen, halogen, or a (C<sub>1</sub>-C<sub>4</sub>) alkyl group; and

R<sup>2</sup> is hydrogen, halogen, or a (C<sub>1</sub>-C<sub>4</sub>) alkyl group.

Preferably, when Y is methyl or ethyl, R<sup>1</sup> and R<sup>2</sup> should not both be hydrogen. Salts of these compounds formed by reacting the compound with acids such as hydrochloric, nitric, sulfuric, etc. are also suitable.

This class of compounds is disclosed in U.S. Pat. No. 4,265,899, Lewis et al., issued May 5, 1981, and incorporated herein by reference. Examples of said compounds are: 5-chloro-2-methyl-4-isothiazolin-3-one; 2-n-butyl-3-isothiazolone; 2-benzyl-3-isothiazolone; 2-phenyl-3-

isothiazolone, 2-methyl-4,5-dichloroisothiazolone; 5-chloro-2-methyl-3-isothiazolone; 2-methyl-4-isothiazolin-3-one; and mixtures thereof. A preferred preservative is a water-soluble mixture of 5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-4-isothiazolin-3-one, more preferably a mixture of about 77% 5-chloro-2-methyl-4-isothiazolin-3-one and about 23% 2-methyl-4-isothiazolin-3-one. a broad spectrum preservative available as a 1.5% aqueous solution under the trade name Kathon® CG by Rohm and Haas Company.

When Kathon® is used as the preservative in the present invention it is present at a level of from about 0.0001% to about 0.01%, preferably from about 0.0002% to about 0.005%, more preferably from about 0.0003% to about 0.003%, most preferably from about 0.0004% to about 0.002%, by weight of the composition.

Other isothiazolins include 1,2-benzisothiazolin-3-one, available under the trade name Proxel® products; and 2-methyl-4,5-trimethylene-4-isothiazolin-3-one, available under the trade name Promexal®. Both Proxel and Promexal are available from Zeneca. They have stability over a wide pH range (i.e., 4-12). Neither contain active halogen and are not formaldehyde releasing preservatives. Both Proxel and Promexal are effective against typical Gram negative and positive bacteria, fungi and yeasts when used at a level from about 0.001% to about 0.5%, preferably from about 0.005% to about 0.05%, and most preferably from about 0.01% to about 0.02% by weight of the usage composition.

(b) Sodium Pyrithione

Another preferred organic sulfur preservative is sodium pyrithione, with water solubility of about 50%. When sodium pyrithione is used as the preservative in the present invention it is typically present at a level of from about 0.0001% to about 0.01%, preferably from about 0.0002% to about 0.005%, more preferably from about 0.0003% to about 0.003%, by weight of the usage composition.

Mixtures of the preferred organic sulfur compounds can also be used as the preservative in the present invention.

(B). Halogenated Compounds

Preferred preservatives for use in the present invention are halogenated compounds. Some non-limiting examples of halogenated compounds suitable for use in the present invention are:

5-bromo-5-nitro-1,3-dioxane, available under the trade name Bronidox L® from Henkel. Bronidox L® has a solubility of about 0.46% in water. When Bronidox is used as the preservative in the present invention it is typically present at a level of from about 0.0005% to about 0.02%, preferably from about 0.001% to about 0.01%, by weight of the usage composition;

2-bromo-2-nitropropane-1,3-diol, available under the trade name Bronopol<sup>®</sup> from Inolex can be used as the preservative in the present invention. Bronopol has a solubility of about 25% in water. When Bronopol is used as the preservative in the present invention it is typically present at a level of from about 0.002% to about 0.1%, preferably from about 0.005% to about 0.05%, by weight of the usage composition;

1,1'-hexamethylene bis(5-(p-chlorophenyl)biguanide), commonly known as chlorhexidine, and its salts, e.g., with acetic and gluconic acids can be used as a preservative in the present invention. The digluconate salt is highly water-soluble, about 70% in water, and the diacetate salt has a solubility of about 1.8% in water. When chlorhexidine is used as the preservative in the present invention it is typically present at a level of from about 0.0001% to about 0.04%, preferably from about 0.0005% to about 0.01%, by weight of the usage composition.

1,1,1-Trichloro-2-methylpropan-2-ol, commonly known as chlorobutanol, with water solubility of about 0.8%; a typical effective level of chlorobutanol is from about 0.1% to about 0.5%, by weight of the usage composition.

4,4'-(Trimethylenedioxy)bis-(3-bromobenzamidine) diisethionate, or dibromopropamidine, with water solubility of about 50%; when dibromopropamidine is used as the preservative in the present invention it is typically present at a level of from about 0.0001% to about 0.05%, preferably from about 0.0005% to about 0.01% by weight of the usage composition.

Mixtures of the preferred halogenated compounds can also be used as the preservative in the present invention.

(C). Cyclic Organic Nitrogen Compounds

Preferred water-soluble preservatives for use in the present invention are cyclic organic nitrogen compounds. Some non-limiting examples of cyclic organic nitrogen compounds suitable for use in the present invention are:

(a) Imidazolidinedione Compounds

Preferred preservatives for use in the present invention are imidazolidinedione compounds. Some non-limiting examples of imidazolidinedione compounds suitable for use in the present invention are:

1,3-bis(hydroxymethyl)-5,5-dimethyl-2,4-imidazolidinedione, commonly known as dimethyloldimethylhydantoin, or DMDM hydantoin, available as, e.g., Glydant<sup>®</sup> from Lonza. DMDM hydantoin has a water solubility of more than 50% in water, and is mainly effective on bacteria. When DMDM hydantoin is used, it is preferable that it be used in combination with a broad spectrum preservative such as Kathon CG<sup>®</sup>, or formaldehyde. A preferred mixture is about a 95:5 DMDM hydantoin to 3-butyl-2-iodopropynylcarbamate mixture, available under the trade

name Glydant Plus<sup>®</sup> from Lonza. When Glydant Plus<sup>®</sup> is used as the preservative in the present invention, it is typically present at a level of from about 0.005% to about 0.2% by weight of the usage composition:

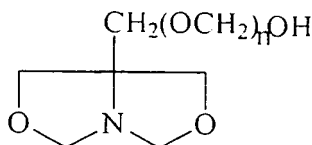
5 N-[1,3-bis(hydroxymethyl)-2,5-dioxo-4-imidazolidinyl]-N,N'-bis(hydroxymethyl) urea, commonly known as diazolidinyl urea, available under the trade name Germall II<sup>®</sup> from Sutton Laboratories, Inc. (Sutton) can be used as the preservative in the present invention. When Germall II<sup>®</sup> is used as the preservative in the present invention, it is typically present at a level of from about 0.01% to about 0.1% by weight of the usage composition:

10 N,N"-methylenebis{N'-[1-(hydroxymethyl)-2,5-dioxo-4-imidazolidinyl]urea}, commonly known as imidazolidinyl urea, available, e.g., under the trade name Abiol<sup>®</sup> from 3V-Sigma, Unicide U-13<sup>®</sup> from Induchem, Germall 115<sup>®</sup> from (Sutton) can be used as the preservative in the present invention. When imidazolidinyl urea is used as the preservative, it is typically present at a level of from about 0.05% to about 0.2%, by weight of the usage composition.

15 Mixtures of the preferred imidazolidinedione compounds can also be used as the preservative in the present invention.

(b) Polymethoxy Bicyclic Oxazolidine

Another preferred water-soluble cyclic organic nitrogen preservative is polymethoxy bicyclic oxazolidine, having the general formula:



20 where n has a value of from about 0 to about 5, and is available under the trade name Nuosept<sup>®</sup> C from Hüls America. When Nuosept<sup>®</sup> C is used as the preservative, it is typically present at a level of from about 0.005% to about 0.1%, by weight of the usage composition.

Mixtures of the preferred cyclic organic nitrogen compounds can also be used as the preservative in the present invention.

25 (D). Low Molecular Weight Aldehydes

(a). Formaldehyde

A preferred preservative for use in the present invention is formaldehyde. Formaldehyde is a broad spectrum preservative which is normally available as formalin which is a 37% aqueous solution of formaldehyde. When formaldehyde is used as the preservative in the present invention, 30 typical levels are from about 0.003% to about 0.2%, preferably from about 0.008% to about 0.1%, more preferably from about 0.01% to about 0.05%, by weight of the usage composition.

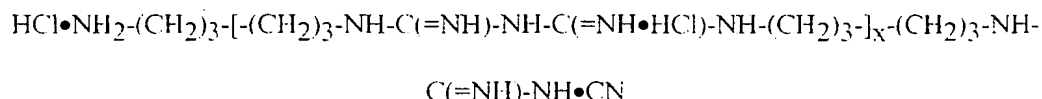


(b) Glutaraldehyde

A preferred preservative for use in the present invention is glutaraldehyde. Glutaraldehyde is a water-soluble, broad spectrum preservative commonly available as a 25% or a 50% solution in water. When glutaraldehyde is used as the preservative in the present invention it is typically present at a level of from about 0.005% to about 0.1%, preferably from about 0.01% to about 0.05%, by weight of the usage composition.

(E). Quaternary Compounds

Preferred preservatives for use in the present invention are cationic and/or quaternary compounds. Such compounds include polyaminopropyl biguanide, also known as polyhexamethylene biguanide having the general formula:



Polyaminopropyl biguanide is a water-soluble, broad spectrum preservative which is available as a 20% aqueous solution available under the trade name Cosmocil CQ<sup>®</sup> from ICI Americas, Inc., or under the trade name Mikrokil<sup>®</sup> from Brooks, Inc.

1-(3-Chlorallyl) -3,5,7-triaza-1-azoniaadamantane chloride, available, e.g., under the trade name Dovicil 200 from Dow Chemical, is an effective quaternary ammonium preservative: it is freely soluble in water; however, it has the tendency to discolor (yellow), therefore it is not highly preferred.

Mixtures of the preferred quaternary ammonium compounds can also be used as the preservative in the present invention.

When quaternary ammonium compounds are used as the preservative in the present invention, they are typically present at a level of from about 0.005% to about 0.2%, preferably from about 0.01% to about 0.1%, by weight of the usage composition.

(F). Dehydroacetic Acid

A preferred preservative for use in the present invention is dehydroacetic acid. Dehydroacetic acid is a broad spectrum preservative preferably in the form of a sodium or a potassium salt so that it is water-soluble. This preservative acts more as a biostatic preservative than a biocidal preservative. When dehydroacetic acid is used as the preservative it is typically used at a level of from about 0.005% to about 0.2%, preferably from about 0.008% to about 0.1%, more preferably from about 0.01% to about 0.05%, by weight of the usage composition.

(G). Phenyl and Phenolic Compounds

Some non-limiting examples of phenyl and phenolic compounds suitable for use in the present invention are:

4,4'-diamidino- $\alpha,\omega$ -diphenoxypropane diisethionate, commonly known as propamidine isethionate, with water solubility of about 16%; and 4,4'-diamidino- $\alpha,\omega$ -diphenoxyhexane diisethionate, commonly known as hexamidine isethionate. Typical effective level of these salts is about 0.0002% to about 0.05% by weight of the usage composition.

Other examples are benzyl alcohol, with a water solubility of about 4%; 2-phenylethanol, with a water solubility of about 2%; and 2-phenoxyethanol, with a water solubility of about 2.67%; typical effective level of these phenyl and phenoxy alcohol is from about 0.1% to about 0.5%, by weight of the usage composition.

(H). Mixtures thereof

The preservatives of the present invention can be used in mixtures in order to control a broad range of microorganisms.

Bacteriostatic effects can sometimes be obtained for aqueous compositions by adjusting the composition pH to an acid pH, e.g., less than about pH 4, preferably less than about pH 3, or a basic pH, e.g., greater than about 10, preferably greater than about 11. Low pH for microbial control is not a preferred approach in the present invention because the low pH can cause chemical degradation of the cyclodextrins. High pH for microbial control is also not preferred because at high pH's, e.g., greater than about 10, preferably greater than about 11, the cyclodextrins can be ionized and their ability to complex with organic materials is reduced. Therefore, aqueous compositions of the present invention should have a pH of from about 3 to about 10, preferably from about 4 to about 8, more preferably from about 4.5 to about 6. The pH is typically adjusted with inorganic molecules to minimize complexation with cyclodextrin.

## II. ARTICLE OF MANUFACTURE

The composition of the present invention can also be used in an article of manufacture comprising said composition plus a spray dispenser. When the commercial embodiment of the article of manufacture is used, it is optional, but preferable, to include the preservative. Therefore, the most basic article of manufacture comprises uncomplexed cyclodextrin, a carrier, and a spray dispenser.

### SPRAY DISPENSER

The article of manufacture herein comprises a spray dispenser, preferably non-manually operated. By "non-manually operated" it is meant that the spray dispenser can be manually activated, but the force required to dispense the odor absorbing composition is

provided by another, non-manual means. Non-manually operated sprayers include, but are not limited to, powered sprayers, air aspirated sprayers, liquid aspirated sprayers, electrostatic sprayers, and nebulizer sprayers. The odor absorbing composition is placed into a spray dispenser in order to be distributed onto the surface. Said spray dispenser is preferably any  
5 of the non-manually activated means for producing a spray of liquid droplets, and preferably not the common ones known in the art, e.g. trigger-type, pump-type, non-aerosol self-pressurized, and aerosol-type spray means. The spray dispenser herein does not normally include those that will substantially foam the clear, aqueous odor absorbing composition. It has been found that the performance is increased by providing smaller particle droplets. Desirably, the Sauter mean  
10 particle diameter is from about 10  $\mu\text{m}$  to about 120  $\mu\text{m}$ , more preferably, from about 20  $\mu\text{m}$  to about 100  $\mu\text{m}$ . Dewrinkling benefits are improved by providing small particles (droplets), as discussed hereinbefore, especially when the surfactant is present.

Any suitable bottle or container can be used with the sprayer, the preferred bottle has good ergonomics. It can be made of any materials such as high density polyethylene, polypropylene,  
15 polyvinyl chloride, polystyrene, polyethylene terephthalate, glass, metal or any other material that forms bottles. Preferably, it is made of high density polyethylene or clear polyethylene terephthalate.

The most preferred sprayers for treating the compositions of this invention to large surface areas and/or objects are non-manually operated sprayers. Non-manually operated sprayers include,  
20 but are not limited to, powered sprayers, air aspirated sprayers, liquid aspirated sprayers, electrostatic sprayers, and nebulizer sprayers.

Powered sprayers include self contained powered pumps that pressurize the aqueous odor-absorbing composition and dispense it through a nozzle to produce a spray of liquid droplets. Powered sprayers are attached directly or remotely through the use of piping/tubing to a reservoir  
25 (such as a bottle) to hold the aqueous odor-absorbing composition. Powered sprayers may include, but are not limited to, centrifugal or positive displacement designs. It is preferred that the powered sprayer be powered by a portable DC electrical current from either disposable batteries (such as commercially available alkaline batteries) or rechargeable battery units (such as commercially available nickel cadmium battery units). Powered sprayers may also be powered by standard AC  
30 power supply available in most buildings. The discharge nozzle design can be varied to create specific spray characteristics (such as spray diameter and particle size). It is also possible to have multiple spray nozzles for different spray characteristics. The nozzle may or may not contain an adjustable nozzle shroud that would allow the spray characteristics to be altered.

Nonlimiting examples of commercially available powered sprayers are disclosed in U.S. Pat. Nos. 4,865,255, Luvisotto, issued Sep. 12, 1989 which is incorporated herein by reference. Preferred powered sprayers are readily available from suppliers such as Solo, Newport News, Virginia (e.g., Solo Spraystar™ rechargeable sprayer, listed as manual part #: US 460 395) and  
5 Multi-sprayer Systems, Minneapolis, Minnesota (e.g., model: Spray 1).

Air aspirated sprayers include the classification of sprayers generically known as "air brushes". A stream of pressurized air draws up the aqueous odor-absorbing composition and dispenses it through a nozzle to create a spray of small liquid. The odor-absorbing composition can be supplied via separate piping/tubing or more commonly is contained in a jar to which the  
10 aspirating sprayer is attached.

Nonlimiting examples of commercially available air aspirated sprayers appears in U.S. Pat. Nos. 1,536,352, Murray, issued Apr. 22, 1924 and 4,221,339, Yoshikawa, issues Sep. 9, 1980; all of said references are incorporated herein by reference. Air aspirated sprayers are readily available from suppliers such as The Badger Air-Brush Co. Franklin Park, Illinois (e.g., model #: 155) and  
15 Wilton Air Brush Equipment, Woodridge, Illinois (e.g., stock #: 415-4000, 415-4001, 415-4100).

Liquid aspirated sprayers are typical of the variety in widespread use to spray garden chemicals. The aqueous odor-absorbing composition is drawn into a fluid stream by means of suction created by a Venturi effect. The high turbulence serves to mix the aqueous odor-absorbing composition with the fluid stream (typically water) in order to provide a uniform  
20 mixture/concentration. It is possible with this method of delivery to dispense the aqueous concentrated odor-absorbing composition of the present invention and then dilute it to a selected concentration with the delivery stream.

Liquid aspirated sprayers are readily available from suppliers such as Chapin Manufacturing Works, Batavia, New York (e.g., model #: 6006).

25 Electrostatic sprayers impart energy to the aqueous odor-absorbing composition via a high electrical potential. This energy serves to atomize and charge the aqueous odor-absorbing composition, creating a spray of fine, charged particles. As the charged particles are carried away from the sprayer, their common charge causes them to repel one another. This has two effects before the spray reaches the target. First, it expands the total spray mist. This is especially  
30 important when spraying to fairly distant, large areas. The second effect is maintenance of original particle size. Because the particles repel one another, they resist collecting together into large, heavier particles like uncharged particles do. This lessens gravity's influence, and increases the charged particle reaching the target. As the mass of negatively charged particles approach the target, they push electrons inside the target inwardly, leaving all the exposed surfaces of the target

with a temporary positive charge. The resulting attraction between the particles and the target overrides the influences of gravity and inertia. As each particle deposits on the target, that spot on the target becomes neutralized and no longer attractive. Therefore, the next free particle is attracted to the spot immediately adjacent and the sequence continues until the entire surface of the target is covered. Hence, charged particles improve distribution and reduce drippage.

Nonlimiting examples of commercially available electrostatic sprayers appears in U.S. Pat. Nos. 5,222,664, Noakes, issued Jun. 29, 1993; 4,962,885, Coffee, issued Oct. 16, 1990; 2,695,002, Miller, issued Nov. 1954; 5,405,090, Greene, issued Apr. 11, 1995; 4,752,034, Kuhn, issued Jun. 21, 1988; 2,989,241, Badger, issued Jun. 1961; all of said patents are incorporated herein by reference. Electrostatic sprayers are readily available from suppliers such as Tae In Tech Co. South Korea and Spectrum, Houston, Texas.

Nebulizer sprayers impart energy to the aqueous odor-absorbing composition via ultrasonic energy supplied via a transducer. This energy results in the aqueous odor-absorbing composition to be atomized. Various types of nebulizers include, but are not limited to, heated, ultrasonic, gas, venturi, and refillable nebulizers.

Nonlimiting examples of commercially available nebulizer sprayers appears in U.S. Pat. Nos. 3,901,443, Mitsui, issued Aug. 26, 1975; 2,847,248, Schmitt, issued Aug. 1958; 5,511,726, Greenspan, issued Apr. 30, 1996; all of said patents are incorporated herein by reference. Nebulizer sprayers are readily available from suppliers such as A&D Engineering, Inc., Milpitas, California (e.g., model A&D Un-231 ultrasonic handy nebulizer) and Amici, Inc., Spring City, Pennsylvania (model: swirler nebulizer).

The preferred article of manufacture herein comprises a non-manually operated sprayer, such as a battery-powered sprayer, containing the aqueous odor-absorbing composition. More preferably the article of manufacture comprises a combination of a non-manually operated sprayer comprising a sprayer head and a separate container of the aqueous odor-absorbing composition, to be added to the sprayer head before use and/or to be separated for filling/refilling. The separate container can contain an usage composition, or a concentrated composition to be diluted before use, and/or to be used with a diluting sprayer, such as with a liquid aspirated sprayer, as described herein above.

Also, as described hereinabove, the separate container (typically a bottle) should have structure that mates with the sprayer head to ensure a solid fit without leakage, even after motion, impact, etc. and when handled by inexperienced consumers. The sprayer desirably can also have an attachment system that is safe and preferably designed to allow for the liquid container that has been emptied to be recharged and/or replaced by another container that is filled (refill bottle). E.g.,

the fluid reservoir can be replaced by a refill container. This can minimize or eliminate problems with refilling the reservoir, including minimizing leakage, if the proper mating and sealing means are present on both the sprayer and the container. Desirably, the sprayer can contain a shroud to ensure proper alignment and/or to permit the use of thinner walls on the replacement container.

5 This minimizes the amount of material to be recycled and/or discarded. The package sealing or mating system can be a threaded closure on the sprayer which replaces the existing closure on the filled and threaded refill container. A sealing gasket across the opening of the refill container is desirably added to provide additional seal security and minimize leakage during manipulation of the refill container to align it with the sprayer. The gasket can be opened by action of the sprayer  
10 closure. These threaded sealing systems can be based on industry standards. However, it is highly desirable to use a threaded sealing system that has non-standard dimensions to ensure that the proper sprayer/refill bottle combination is always used. This helps prevent the use of fluids that are potentially hazardous, which could then be dispensed when the sprayer is used for its intended purpose.

15 An alternative sealing system can be based on one or more interlocking lugs and channels. Such systems are commonly referred to as "bayonet" systems. Such systems can be made in a variety of configurations, thus better ensuring that the proper replacement fluid is used. For convenience, the locking system can also be one that enables the provision of a "child-proof" cap on the refill bottle. This "lock-and-key" type of system thus provides highly desirable safety  
20 features. There are a variety of ways to design such lock and key sealing systems.

Care must be taken, however, to prevent the system from making the replacement and sealing operation too difficult. If desired, the lock and key can be integral to the sealing mechanism. However, for the purpose of ensuring that the correct recharge or refill is used, the interlocking pieces can be separate from the sealing system. E.g., the shroud and the container  
25 could be designed for compatibility. In this way, the unique design of the container alone could provide the requisite assurance that the proper recharge/refill is used.

Examples of threaded closures and bayonet systems can be found in U.S. Pat. 4,781,311, issued Nov. 1, 1988 to Dunning et al. (Angular Positioned Trigger Sprayer with Selective Snap-Screw Container Connection), U.S. Pat. 5,560,505, issued Oct. 1, 1996 to Schneider et al.  
30 (Container and Stopper Assembly Locked Together by Relative Rotation and Use Thereof), and U.S. Pat. 5,725,132, issued Mar. 10, 1998 to Foster et al. (Dispenser with Snap-Fit Container Connection), all said patents being incorporated herein by reference.

### III. METHOD OF USE

The cyclodextrin solution, which contains, e.g., surfactant and/or antimicrobial compound, etc., can be used by distributing, e.g., by placing the aqueous solution into a dispensing means, preferably a spray dispenser and spraying an effective amount onto the desired surface or article. An effective amount as defined herein means an amount sufficient to absorb odor to the point that it is not discernible by the human sense of smell yet not so much as to saturate or create a pool of liquid on said article or surface and so that when dry there is no visual deposit readily discernible. Distribution can be achieved by using a spray device, a roller, a pad, etc.

Preferably, the present invention does not encompass distributing the cyclodextrin solution on to shiny surfaces including, e.g., chrome, glass, smooth vinyl, leather, shiny plastic, shiny wood, etc. It is preferable not to distribute the cyclodextrin solution onto shiny surfaces because spotting and filming can more readily occur on the surfaces. Although the cyclodextrin solution can be used on human skin, care should be taken when an antimicrobial active is present in the composition.

The present invention encompasses the method of spraying an effective amount of cyclodextrin solution onto household surfaces. Preferably said household surfaces are selected from the group consisting of countertops, cabinets, walls, floors, bathroom surfaces and kitchen surfaces.

The present invention encompasses the method of spraying a mist of an effective amount of cyclodextrin solution onto fabric and/or fabric articles. Preferably, said fabric and/or fabric articles include, but are not limited to, clothes, curtains, drapes, upholstered furniture, carpeting, bed linens, bath linens, tablecloths, sleeping bags, tents, car interior, etc.

The present invention encompasses the method of spraying a mist of an effective amount of cyclodextrin solution onto and into shoes wherein said shoes are not sprayed to saturation.

The present invention encompasses the method of spraying a mist of an effective amount of cyclodextrin solution onto shower curtains.

The present invention relates to the method of spraying a mist of an effective amount of cyclodextrin solution onto and/or into garbage cans and/or recycling bins.

The present invention relates to the method of spraying a mist of an effective amount of cyclodextrin solution into the air to absorb malodor.

The present invention relates to the method of spraying a mist of an effective amount of cyclodextrin solution into and/or onto major household appliances including, but not limited to: refrigerators, freezers, washing machines, automatic dryers, ovens, microwave ovens, dishwashers etc., to absorb malodor.

The present invention relates to the method of spraying a mist of an effective amount of cyclodextrin solution onto cat litter, pet bedding and pet houses to absorb malodor.

The present invention relates to the method of spraying a mist of an effective amount of cyclodextrin solution onto household pets to absorb malodor.

The present invention encompasses the method of spraying a mist of an effective amount of cyclodextrin solution, using a non-manually operated sprayer, such as a battery-powered sprayer, onto large areas, such as: a hotel room interior surfaces or a nursing home room interior surfaces, including, e.g., walls, curtains, drapes, upholstered furnitures, carpeting, bed covers, trash cans, and the like.

The presence of the surfactant promotes spreading of the solution and the antimicrobial active provides improved odor control as well as antimicrobial action, by minimizing the formation of odors. Both the surfactant and the antimicrobial active provide improved performance and the mixture is especially good. When the compositions are applied in the form of the very small particles, as disclosed hereinbefore, additional benefits are found, since the distribution is even further improved and overall performance is improved.

All percentages, ratios, and parts herein, in the Specification, Examples, and Claims are by weight and are approximations unless otherwise stated.

The following are non-limiting examples of the instant composition. Perfume compositions that are used herein are as follows:

	A	B	C
Perfume			
<u>Perfume Ingredients</u>	<u>Wt.%</u>	<u>Wt.%</u>	<u>Wt.%</u>
Anisic aldehyde	-	-	2
Benzophenone	3	5	-
Benzyl acetate	10	15	5
Benzyl salicylate	5	20	5
Cedrol	2	-	-
Citronellol	10	-	5
Coumarin	-	-	5
Cymal	-	-	3
Dihydromyrcenol	10	-	5
Flor acetate	5	-	5
Galaxolide	10	-	-
Lilial	10	15	20
Linalyl acetate	4	-	5
Linalool	6	15	5



47

Methyl dihydro jasmonate	3	10	5
Phenyl ethyl acetate	2	5	1
Phenyl ethyl alcohol	15	10	20
alpha-Terpineol	5	-	8
Vanillin	-	-	1
Total	100	100	100

	<u>D</u>	<u>E</u>
<u>Perfume Material</u>	<u>Wt.%</u>	<u>Wt.%</u>
Amyl salicylate	8	-
Benzyl acetate	8	8
Benzyl Salicylate	-	2
Citronellol	7	27
Dihydromyrcenol	2	-
Eugenol	4	-
Flor acetate	8	-
Galaxolide	1	-
Geraniol	5	-
Hexyl cinnamic aldehyde	2	-
Hydroxycitronellal	3	-
Lilial	2	-
Linalool	12	13
Linalyl acetate	5	-
Lylal	3	-
Methyl dihydrojasmonate	3	-
Nerol	2	-
Phenoxy ethyl propionate	-	3
Phenylethyl acetate	5	17
Phenylethyl alcohol	8	17
alpha-Terpineol	5	13
alpha-Terpinene	5	-
Tetrahydromyrcenol	2	-
Total	100	100

Perfume F

<u>Perfume Ingredients</u>	<u>Wt. %</u>
Benzophenone	0.50
Benzyl acetate	3.00
Benzyl propionate	1.00
beta gamma Hexenol	0.20
Cetalox	0.10
cis 3 Hexenyl acetate	0.15
cis Jasmone	0.10
cis-3-Hexenyl salicylate	1.00
Citral	0.50
Citronellal nitrile	0.70
Citronellol	3.65
Coumarin	0.70
Cyclal C	0.30
Cyclo galbanate	0.40
beta Damascone	0.05
Dihydro myrcenol	1.00
Ebanol	0.50
Flor acetate	5.00
Florhydral	0.70
Fructose	8.50
Frutene	3.00
Geranyl nitrile	0.40
Heliotropin	0.70
Hydroxycitronellal	2.50
Linalool	2.00
Linalyl acetate	1.50
Methyl dihydro jasmonate	5.00
Methyl heptine carbonate	0.05
Methyl iso butenyl tetrahydro pyran	0.15
Methyl phenyl carbinyl acetate	0.50
Nonalactone	1.50
P. T. Bucinal	8.40
para Hydroxy phenyl butanone	1.30

Phenoxy ethanol	28.55
Phenyl ethyl acetate	0.80
Phenyl ethyl alcohol	10.00
Prenyl acetate	1.50
Terpineol	1.50
Verdox	2.10
Vanillin	0.50
Total	100.00

## Perfume G

<u>Perfume Ingredients</u>	<u>Wt. %</u>
Anisic aldehyde	2.80
Benzyl acetone	1.00
cis 3 Hexenyl acetate	0.30
Citronellal nitrile	1.30
Citronellol	6.90
Coumarin	1.30
Cyclal C	0.30
Cyclo galbanate	0.70
Cymal	1.05
delta Damascone	0.05
Dihydro myrcenol	1.30
Dipropylene glycol	10.20
Dodecalactone	0.50
Ebanol	0.10
Ethyl vanillin	0.10
Flor acetate	8.00
Florhydral	1.30
Fructose	6.00
Galaxolide (50% in isopropyl myristate)	4.00
gamma Methyl ionone	1.00
Geranyl nitrile	0.30
Helional	1.50
Hydroxycitronellal	2.00

Iso bornyl acetate	1.80
Ligustral	0.10
Linalool	2.50
Methyl dihydro jasmonate	6.20
Methyl heptine carbonate	0.10
Methyl iso butenyl tetrahydro pyran	0.30
Methyl phenyl carbonyl acetate	1.00
Orange terpenes	2.00
P. T. Bucinal	10.00
Phenyl ethyl alcohol	20.00
Prenyl acetate	1.50
Verdox	2.50
Total	100.00

The following are non-limiting examples of the instant composition. The following compositions are prepared by mixing and dissolving the ingredients into clear solutions.

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Examples to Show Disinfection Synergy  
of Antimicrobials and Surfactants in the Presence of Cyclodextrin

Examples	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>V</u>	<u>VI</u>
<u>Ingredients</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>
HPBCD(a)	1.0	1.0	1.0	1.0	1.0	1.0
Silwet L-7600	--	0.1	--	0.1	0.1	--
Pluronic P84	--	--	--	--	--	0.1
Chlorhexidine	--	--	0.05	0.01	0.02	0.05
Kathon	3 ppm	3 ppm	3 ppm	3 ppm	3 ppm	3 ppm
HCl	to pH 4	to pH 4	to pH 4	to pH 4	to pH 4	to pH 4
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

(a) Hydroxypropyl beta-cyclodextrin.

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Approximate Bacterial Log Reduction Using Compositions I-VI

51.

<u>Approx.</u>				
<u>Exposure</u>				
<u>Time</u>				
<u>Composition</u>	(minutes)	<u>E. coli</u>	<u>S.aureus</u>	<u>S. choleserius</u>
I	5	0	0	0
I	10	0	0	0
I	20	1	1	1
II	5	0	0	0
II	10	0	0	0
II	20	1	1	1
III	5	>5	3	>5
III	10	>5	4	>5
III	20	>5	5	>5
IV	5	>5	3	>5
IV	10	>5	4	>5
IV	20	>5	5	>5
V	5	>5	>5	>5
V	10	>5	>5	>5
V	20	>5	>5	>5
VI	5	--	3	--
VI	10	--	5	--
VI	20	--	>5	--

The above data show that the surfactants can improve the reduction in bacteria over the chlorhexidine alone, in the presence of cyclodextrin, especially on S. aureus.

5

Examples to Show Disinfection Synergy  
of Antimicrobials and Surfactants in the Absence of Cyclodextrin

Examples	<u>VII</u>	<u>VIII</u>	<u>IX</u>	<u>X</u>	<u>XI</u>	<u>XII</u>	<u>XIII</u>
<u>Ingredients</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>
Chlorhexidine	0.01	--	0.01	0.01	0.05	0.05	0.05
Silwet L-7600	--	0.1	0.1	--	--	0.1	--
Pluronic P84	--	--	--	0.1	--	--	0.1

Distilled water      Bal.      Bal.      Bal.      Bal.      Bal.      Bal.      Bal.

Approximate Bacterial Log Reduction Using Compositions VII-XIII

<u>Composition</u>	<u>Approx.</u>		
	<u>Exposure</u>		
	<u>Time</u>	<u>S.aureus</u>	<u>P. aeruginosa</u>
	(minutes)	(gram+)	(gram-)
VII	5	0	0
VII	10	0	>5
VII	20	0	>5
VIII	5	0	0
VIII	10	0	0
VIII	20	0	0
IX	5	0	>5
IX	10	3	>5
IX	20	4	>5
X	5	0	--
X	10	0	--
X	20	0	--
XI	5	0	--
XI	10	5	--
XI	20	>5	--
XII	5	0	--
XII	10	>5	--
XII	20	>5	--
XIII	5	0	--
XIII	10	>5	--
XIII	20	>5	--

The above data show that the surfactants can improve the reduction in bacteria over the  
 5 chlorhexidine alone, in the absence of cyclodextrin. However, the Silwet surfactants provide a  
 surprisingly large improvement.

Examples      XIV      XV      XVI      XVII

<u>Ingredients</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>
HPBCD(a)	1.0	1.0	1.0	1.0
Silwet L-7600	0.1	0.1	0.1	0.1
Chlorhexidine diacetate	0.03	0.05	--	--
Chlorhexidine dihydrochloride	--	--	0.03	0.05
Kathon	3 ppm	3 ppm	3 ppm	3 ppm
HCl	to pH 4	to pH 4	to pH 4	to pH 4
Distilled water	Bal.	Bal.	Bal.	Bal.

(a) Hydroxypropyl beta-cyclodextrin.

Approximate Bacterial Log Reduction Using Compositions III and XIV-XVII

<u>Composition</u>	<u>Approx. Exposure Time (minutes)</u>	<u>S.aureus (gram +)</u>
III	5	3
III	10	4
III	20	5
XIV	5	3
XIV	10	4
XIV	20	>5
XV	5	3
XV	10	>5
XV	20	>5
XVI	5	3
XVI	10	5
XVI	20	>5
XVII	5	3
XVII	10	>5
XVII	20	>5

5

<u>Examples</u>	<u>XVIII</u>	<u>XTX</u>	<u>XX</u>	<u>XXI</u>	<u>XXII</u>	<u>XXIII</u>
<u>Ingredients</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>
HPBCD(a)	1.0	--	0.5	--	0.5	--

RAMEB <sup>(b)</sup>	--	1.0	--	1.0	--	1.0
HPACD <sup>(c)</sup>	--	--	0.5	--	0.5	--
$\alpha$ -Cyclodextrin						0.5
ZnCl <sub>2</sub>	1.0	1.0	1.0	1.0	1.0	0.5
Silwet L-7600	0.15	--	--	--	--	0.05
Silwet L-7602	--	0.4	--	--	--	--
Silwet L-7604	--	--	0.1	--	--	--
Silwet L-7605	--	--	--	0.1	--	--
Silwet L-7657	--	--	--	--	0.05	--
Perfume A	0.1	--	--	--	--	--
Perfume B	--	0.2	--	--	--	--
Perfume C	--	--	0.05	--	--	--
Perfume E	--	--	--	0.1	--	--
Perfume F	--	--	--	--	0.05	--
Perfume G	--	--	--	--	--	0.1
Propylene glycol	0.06	--	--	--	0.1	--
Kathon	3 ppm	3 ppm	3 ppm	3 ppm	3 ppm	3 ppm
HCl	to pH 4	to pH 4	to pH 4	to pH 4	to pH 4	to pH 4
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

(a) Hydroxypropyl beta-cyclodextrin.

(b) Randomly methylated beta-cyclodextrin.

Examples	<u>XXIV</u>	<u>XXV</u>	<u>XXVI</u>	<u>XXVII</u>	<u>XXVIII</u>	<u>XXIX</u>
Ingredients	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>
HPBCD <sup>(a)</sup>	1.0	--	1.5	--	1.0	--
RAMEB <sup>(b)</sup>	--	1.0	--	1.0	--	2.0
ZnCl <sub>2</sub>	1.0	1.0	1.0	1.0	1.0	0.5
Pluronic L-101	0.2	--	--	--	--	0.05
Pluronic L-81	--	0.1	--	--	--	--
Pluronic L-44	--	--	0.1	--	--	--
Pluronic L-43	--	--	--	0.05	--	--
Pluronic F-38	--	--	--	--	0.2	--
Pluronic P-84	--	--	--	--	--	0.1
Perfume A	0.1	--	--	--	--	--



55

Perfume B	--	0.05	--	--	--	--
Perfume C	--	--	0.05	--	--	--
Perfume E	--	--	--	0.1	--	--
Perfume F	--	--	--	--	0.15	--
Perfume G	--	--	--	--	--	0.1
Kathon	3 ppm	3 ppm	3 ppm	3 ppm	3 ppm	3 ppm
HCl	to pH 4	to pH 4	to pH 4	to pH 4	to pH 4	to pH 4
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.

(a) Hydroxypropyl beta-cyclodextrin.

(b) Randomly methylated beta-cyclodextrin.

Examples	<u>XXX</u>	<u>XXXI</u>	<u>XXXII</u>	<u>XXXIII</u>
<u>Ingredients</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>
HPBCD(a)	1.0	--	0.5	1.0
RAMEB(b)	--	1.0	--	--
HPACD(c)	--	--	0.5	--
$\alpha$ -Cyclodextrin	--	--	--	0.5
Pluronic 10 R5	0.2	--	--	--
Pluronic 25 R1	--	0.1	--	--
Tetronic 901	--	--	0.1	--
Tetronic 908	--	--	--	0.05
Perfume D	0.1	--	--	--
Perfume E	--	0.05	--	--
Perfume F	--	--	0.05	--
Perfume G	--	--	--	0.05
Kathon	3 ppm	3 ppm	3 ppm	3 ppm
HCl	to pH 4.5	to pH 4.5	to pH 4.5	to pH 4.5
Distilled water	Bal.	Bal.	Bal.	Bal.

5

(a) Hydroxypropyl beta-cyclodextrin.

(b) Randomly methylated beta-cyclodextrin.

(c) Hydroxypropyl alpha-cyclodextrin.

Examples	<u>XXXIV</u>	<u>XXXV</u>	<u>XXXVI</u>
<u>Ingredients</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>
HPBCD(a)	1.0	--	1.5
RAMEB(b)	--	1.0	--
Tetronic 70 R2	0.2	--	--
Tetronic 130 R2	--	0.1	--
Dowfax 3B2	--	--	0.1
Perfume A	0.1	--	--
Perfume B	--	0.05	--
Perfume F	--	--	0.05
Kathon	3 ppm	3 ppm	3 ppm
HCl	to pH 4.5	to pH 4.5	to pH 4.5
Distilled water	Bal.	Bal.	Bal.

(a) Hydroxypropyl beta-cyclodextrin.

(b) Randomly methylated beta-cyclodextrin.

Examples	<u>XXXVII</u>	<u>XXXVIII</u>	<u>XXXIX</u>	<u>XXXX</u>	<u>XXXXI</u>
<u>Ingredients</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>	<u>Wt%</u>
HPBCD(a)	1.0	--	--	--	--
RAMEB(b)	--	1.0	--	--	--
Pluronic L-44	0.2	--	0.1	--	--
Tetronic 901	--	0.1	--	0.1	--
Silwet L-7604	--	--	--	--	0.1
Barquat 4250(c)	0.03	--	--	--	0.04
Bardac 2050(d)	--	0.03	--	0.03	--
Hyamine 1622(e)			0.05		
Perfume E	0.1	--	--	--	--
Perfume F	--	0.05	--	0.1	--
Perfume G	--	--	0.1		0.05
Kathon	3 ppm	3 ppm	3 ppm	3 ppm	3 ppm
HCl	to pH 4.5	to pH 4.5	to pH 3.5	to pH 3.5	to pH 3.5
Distilled water	Bal.	Bal.	Bal.	Bal.	Bal.

- (a) Hydroxypropyl beta-cyclodextrin.
- (b) Randomly methylated beta-cyclodextrin.
- (c) Benzalkonium chloride, 50% solution.
- (d) Dioctyl dimethyl ammonium chloride, 50% solution.
- 5 (e) Diisobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride, 50% solution.

The compositions of the above Examples are sprayed onto clothing using, e.g., the TS-800 sprayer from Calmar, and allowed to evaporate off of the clothing.

10 Hydroxyethyl alpha-cyclodextrin and hydroxyethyl beta-cyclodextrin are obtained as a mixture from the hydroxyethylation reaction of a mixture of alpha-cyclodextrin and beta-cyclodextrin. They can be substituted for the HP-B-CD.

The compositions of the above Examples are sprayed onto clothing, a kitchen countertop, using a blue inserted Guala<sup>®</sup> trigger sprayer, available from Berry Plastics Corp. and a cylindrical Euromist II<sup>®</sup> pump sprayer available from Seaquest Dispensing, respectively, and allowed to  
15 evaporate off of the clothing.

The compositions of the above Examples contained in rechargeable battery-operated Solo Spraystar sprayers are sprayed onto hotel room interior surfaces or a nursing home room interior surfaces, including, e.g., walls, curtains, drapes, upholstered furnitures, carpeting, bed covers, trash cans, and the like, and allowed to evaporate off of these surfaces. The level of coverage is uniform  
20 and the ease of application is highly superior to conventional manually operated sprayers.

The polyalkylene oxide polysiloxane surfactants like the Silwet surfactants provide substantial improvements in the kill of the indicated common organisms. The Pluronic surfactants provide some improvement, but much less.

## WHAT IS CLAIMED IS:

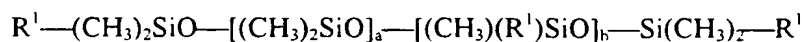
1. An article of manufacture characterized by a non-manually operated spray dispenser having a spray head and a reservoir, said spray dispenser optionally being selected from the group consisting of: powered sprayer, said powered sprayer optionally being a battery-operated sprayer,  
5 consisting of: powered sprayer, said powered sprayer optionally being a battery-operated sprayer, and said battery-operated sprayer optionally being a rechargeable battery-operated sprayer; air aspirated sprayer; liquid aspirated sprayer; electrostatic sprayer; and nebulizer sprayer, and said reservoir containing a stable, aqueous odor-absorbing composition characterized by:
  - A. an effective amount to absorb malodors of solubilized, uncomplexed  
10 cyclodextrin, optionally, said cyclodextrin being present at a level of from 0.01% to 20% by weight of the composition;
  - B. optionally, an effective amount to improve the performance of the composition, of cyclodextrin compatible surfactant;
  - C. optionally, an effective amount, to kill, or reduce the growth of  
15 microorganisms, of cyclodextrin compatible and water soluble antimicrobial active;
  - D. optionally, an effective amount to improve acceptance of the composition of hydrophilic perfume containing at least 50% by weight of the perfume of ingredients having a ClogP of less than 3.5 and, optionally, a minor amount of perfume ingredients selected from the group consisting of ambrox, bacdanol, benzyl salicylate, butyl anthranilate, cetalex,  
20 damascenone, alpha-damascone, gamma-dodecalactone, ebanol, herbavert, cis-3-hexenyl salicylate, alpha-ionone, beta-ionone, alpha-isomethylionone, lillial, methyl nonyl ketone, gamma-undecalactone, undecylenic aldehyde, and mixtures thereof;
  - E. optionally, from 0.01% to 3% by weight of the composition of low molecular weight polyol;
  - 25 F. optionally, from 0.001% to 0.3% by weight of the composition of aminocarboxylate chelator;
  - G. optionally, an effective amount of metallic salt for improved odor benefit;
  - H. optionally, an effective amount of solubilized, water-soluble, antimicrobial preservative; and
  - 30 I. aqueous carrier,said composition having an effective amount of either (B), (C), or both (B) and (C) and/or said composition being essentially free of any material that would soil or stain fabric under usage conditions and having a pH of more than 3.5, and/or said composition being packaged in a container that is capable of dispensing said composition as small droplets  
35 having a weight average diameter of from 10  $\mu$ m to 120  $\mu$ m.

2. The article according to Claim 1 wherein said cyclodextrin is selected from the group consisting of beta-cyclodextrin, alpha-cyclodextrin, gamma-cyclodextrin, derivatives of said cyclodextrins, and mixtures thereof, said cyclodextrin derivatives optionally being selected from  
 40 the group consisting of methyl substituted cyclodextrins, ethyl substituted cyclodextrins, hydroxyalkyl substituted cyclodextrins, branched cyclodextrins, cationic cyclodextrins, quaternary ammonium cyclodextrins, anionic cyclodextrins, amphoteric cyclodextrins, cyclodextrins wherein at least one glucopyranose unit has a 3-6-anhydro-cyclomalto structure, and mixtures thereof.

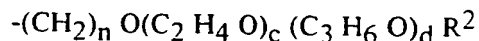
3. The article according to Claim 2 wherein said cyclodextrin derivative is either: (a)  
 45 methylated beta-cyclodextrin; (b) mixture of methylated alpha-cyclodextrin and methylated beta-cyclodextrin; (c) hydroxypropyl beta-cyclodextrin; or (d) mixture of hydroxypropyl alpha-cyclodextrin and hydroxypropyl beta-cyclodextrin.

4. The article according to any of Claims 1-3 wherein either: (a) said cyclodextrin is  
 50 present at a level of from 0.01% to 20% by weight of the composition and said surfactant is present at a level of from 0.01% to 8% by weight of the composition; (b) said cyclodextrin is present at a level of from 0.01% to 5% by weight of the composition and said surfactant is present at a level of from 0.01% to 2% by weight of the composition; (d) said cyclodextrin is present at a level of from 0.1% to 3%, by weight of the composition and said surfactant is  
 55 present at a level of from 0.03% to 0.6% by weight of the composition; or (e) said cyclodextrin is present at a level of from 0.5% to 2%, by weight of the composition and said surfactant is present at a level of from 0.05% to 0.3% by weight of the composition.

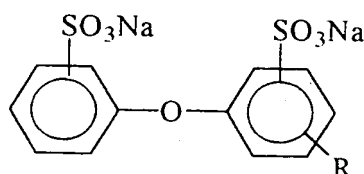
5. The article according to any of Claims 1-4 wherein said surfactant is present in an  
 60 effective amount and is selected from the group consisting of: (1) block copolymers of ethylene oxide and propylene oxide, optionally either (a) block copolymer of ethylene oxide and propylene oxide is based on ethylene glycol, propylene glycol, glycerol, trimethylolpropane, ethylenediamine, or mixtures thereof as the initial reactive hydrogen compound or a surfactant which has the general formula  $H(EO)_n(PO)_m(EO)_nH$ , wherein EO is an ethylene oxide group;  
 65 PO is a propylene oxide group; n and m are numbers that indicate the average number of the groups in the surfactants; n ranges from 2 to 100; and m ranges from 10 to 100; (2) polyalkyleneoxide polysiloxanes, optionally, polyalkyleneoxide polysiloxane surfactant having the general formula:



wherein  $a + b$  are from 1 to 50, and each  $R^1$  is selected from the group consisting of methyl and one or more random poly(ethyleneoxide/propyleneoxide) copolymer groups having the general formula:



- 75 wherein  $n$  is 3 or 4; total  $c$  for all polyalkyleneoxy side groups has a value of from 1 to 100;  $d$  is from 0 to 14;  $c+d$  has a value of from 5 to 150; and each  $R^2$  is the same or different and is selected from the group consisting of hydrogen, an alkyl having 1 to 4 carbon atoms, and an acetyl group; (3) alkyl diphenyl oxide disulfonate anionic surfactants, having the general formula:



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wherein  $R$  is an alkyl group; and (4) mixtures thereof.

6. The article according to Claim 5 wherein said surfactant provides a surface tension of from 20 dyne/cm to 45 dyne/cm.

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7. The article according to any of Claims 1-6 wherein either (1) said antimicrobial active is selected from the group consisting of: bis-biguanide alkane water soluble salt selected from the group consisting of: chlorides, bromides, sulfates, alkyl sulfonates, phenylsulfonates, p-methylphenyl sulfonates, nitrates, acetates, gluconates, and mixtures thereof at a level of from 0.001% to 0.4% by weight of the composition; (2) said bis-biguanide alkane water soluble salt is selected from the group consisting of: chlorhexidine; (1) 1,6-bis-(2-ethylhexylbiguanidohexane)dihydrochloride; 1,6-di-( $N_1, N_1'$ -phenyldiguanido- $N_5, N_5'$ )-hexane tetrahydrochloride; 1,6-di-( $N_1, N_1'$ -phenyl- $N_1, N_1'$ -methyldiguanido- $N_5, N_5'$ )-hexane dihydrochloride; 1,6-di( $N_1, N_1'$ -o-chlorophenyldiguanido- $N_5, N_5'$ )-hexane dihydrochloride; 1,6-di( $N_1, N_1'$ -2,6-dichlorophenyldiguanido- $N_5, N_5'$ )hexane dihydrochloride; 1,6-di[ $N_1, N_1'$ -.beta.-(p-methoxyphenyl) diguanido- $N_5, N_5'$ ]-hexane dihydrochloride; 1,6-di( $N_1, N_1'$ -.alpha.-methyl-.beta.-phenyldiguanido- $N_5, N_5'$ )-hexane dihydrochloride; 1,6-di( $N_1, N_1'$ -p-nitrophenyldiguanido- $N_5, N_5'$ )hexane dihydrochloride; omega:omega'-di-( $N_1, N_1'$ -phenyldiguanido- $N_5, N_5'$ )-di-n-propylether dihydrochloride; omega:omega'-di( $N_1, N_1'$ -p-chlorophenyldiguanido- $N_5, N_5'$ )-di-n-propylether tetrahydrochloride; 1,6-di( $N_1, N_1'$ -2,4-dichlorophenyldiguanido- $N_5, N_5'$ )hexane tetrahydrochloride; 1,6-di( $N_1, N_1'$ -p-methylphenyldiguanido- $N_5, N_5'$ )hexane dihydrochloride; 1,6-di( $N_1, N_1'$ -2,4,5-
- 90
- 95
- 100

trichlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')hexane tetrahydrochloride; 1,6-di[N<sub>1</sub>,N<sub>1</sub>'-alpha.-(p-chlorophenyl) ethyldiguanido-N<sub>5</sub>,N<sub>5</sub>'] hexane dihydrochloride; omega..omega.'di(N<sub>1</sub>, N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')m-xylene dihydrochloride; 1,12-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') dodecane dihydrochloride; 1,10-di(N<sub>1</sub>,N<sub>1</sub>'-phenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-decane tetrahydrochloride; 1,12-di(N<sub>1</sub>,N<sub>1</sub>'-phenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') dodecane tetrahydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-o-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>') hexane dihydrochloride; 1,6-di(N<sub>1</sub>,N<sub>1</sub>'-p-chlorophenyldiguanido-N<sub>5</sub>,N<sub>5</sub>')-hexane tetrahydrochloride; ethylene bis (1-tolyl biguanide); ethylene bis (p-tolyl biguanide); ethylene bis(3,5-dimethylphenyl biguanide); ethylene bis(p-tert-amylphenyl biguanide); ethylene bis(nonylphenyl biguanide); ethylene bis (phenyl biguanide); ethylene bis (N-butylphenyl biguanide); ethylene bis (2,5-diethoxyphenyl biguanide); ethylene bis(2,4-dimethylphenyl biguanide); ethylene bis(o-diphenylbiguanide); ethylene bis(mixed amyl naphthyl biguanide); N-butyl ethylene bis(phenylbiguanide); trimethylene bis(o-tolyl biguanide); N-butyl trimethylene bis(phenyl biguanide); and the corresponding pharmaceutically acceptable salts of all of the above including the acetates; gluconates; hydrochlorides; hydrobromides; citrates; bisulfites; fluorides; polymaleates; N-coconutalkylsarcosinates; phosphites; hypophosphites; perfluorooctanoates; silicates; sorbates; salicylates; malcates; tartrates; fumarates; ethylenediaminetetraacetates; iminodiacetates; cinnamates; thiocyanates; arginates; pyromellitates; tetracarboxybutyrates; benzoates; glutarates; monofluorophosphates; and perfluoropropionates, and mixtures thereof; or (3) said antimicrobial active is present and is quaternary ammonium compound at a level of from 0.001% to 0.8% by weight of the composition or, optionally, said quaternary ammonium compound is at a level of from 0.001% to 0.4% by weight of the composition and is selected from the group consisting of: (1) benzalkonium chlorides; (2) substituted benzalkonium chlorides; (3) di(C<sub>6</sub>-C<sub>14</sub>)alkyl ammonium salt; (4) N-(3-chloroallyl) hexaminium chloride; (5) benzethonium chloride; (6) methylbenzethonium chloride; (7) cetylpyridinium chloride; and (8) mixtures thereof.

8. The article according to Claim 7 wherein either: (1) said cyclodextrin is present at a level of from 0.01% to 5% by weight of the composition and said antimicrobial active is present at a level of from 0.05% to 0.2% by weight of the composition; (2) said cyclodextrin is present at a level of from 0.1% to 3%, by weight of the composition and said antimicrobial active is present at a level of from 0.03% to 0.6% by weight of the composition; (3) said cyclodextrin is present at a level of from 0.5% to 2%, by weight of the composition and said antimicrobial active is present at a level of from 0.05% to 0.3% by weight of the composition; or (4) said cyclodextrin is present at a level of from 0.1% to 5%, by weight of the composition, said surfactant is present at a level of from 0.01% to 8% by weight of the

composition and said antimicrobial active is quaternary ammonium compound at a level of  
140 from 0.001% to 0.4% by weight of the compositions.

9. The article according to any of Claims 1-8 wherein said surfactant is a polyalkyleneoxide polysiloxane and additionally comprising at least one of D. - H.

145 10. The article according to any of Claims 1-9 wherein the composition is clear.

11. The article according to any of Claims 1-10 additionally containing at least one of:  
(1) from 0.01% to 3%, by weight of the composition, of low molecular weight polyol with  
relatively high boiling points, as compared to water, selected from the group consisting of:  
150 glycerol; ethylene glycol; propylene glycol; diethylene glycol; dipropylene glycol; or mixtures  
thereof; (2) an effective amount of polyanionic acid or alkali metal salt thereof, having an  
average molecular weight of less than 20,000, said polyanionic acid or alkali metal salt  
thereof optionally being from 0.001% to 3% by weight of the composition of said polyacrylic  
acid or alkali metal salt thereof, having an average molecular weight of less than 5,000; (3)  
155 from 0.001% to 0.8% by weight of the composition of quaternary compounds containing two  
 $C_{1-4}$  alkyl and/or hydroxy alkyl groups and two  $C_{6-14}$  alkyl groups; and (4) , an effective  
amount of enzyme for improved odor control benefit.

160 12. The article according to Claim 1 wherein said reservoir is attached to said spray head by  
means allowing the reservoir to be replaced by a refill container, said spray head optionally having  
a structure that mates with the structures of said refill container and/or said reservoir to ensure a  
good seal and proper positioning of the container and/or reservoir with respect to said spray  
dispenser.

165



# INTERNATIONAL SEARCH REPORT

Int. Patent Application No.

PCT/US 98/25797

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C11D3/22 C11D17/04 A61L9/01

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C11D A61L D06M A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 04937 A (PROCTER & GAMBLE) 22 February 1996 see page 1, line 24 - page 34, line 12 ---	1
X	WO 96 04938 A (PROCTER & GAMBLE) 22 February 1996 see page 3, line 10 - page 30, line 12 ---	1
X	WO 96 04939 A (PROCTER & GAMBLE) 22 February 1996 see page 4, line 1 - line 15 see page 24, line 33 - page 25, line 3 see page 28, line 6 - line 13 ---	1
X	WO 96 04940 A (PROCTER & GAMBLE) 22 February 1996 see page 2, line 26 - page 17, line 31 see page 19, line 22 - line 29 ---	1
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"Z" document member of the same patent family

Date of the actual completion of the international search

29 March 1999

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08/04/1999

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## INTERNATIONAL SEARCH REPORT

Int ional Application No

PCT/US 98/25797

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 96 05358 A (PROCTER & GAMBLE) 22 February 1996 see page 3, line 33 - page 8, line 31 ---	1
A	WO 96 15309 A (PROCTER & GAMBLE) 23 May 1996 see page 2, line 8 - line 26 see claims ---	1
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A	US 3 600 325 A (KAUFMAN KARL L ET AL) 17 August 1971 see the whole document ---	1
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A,P	WO 98 17240 A (PROCTER & GAMBLE) 30 April 1998 see page 3, line 9 - page 5, line 10 see page 7, line 4 - line 12 see page 14, line 26 - page 15, line 19 ---	1
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